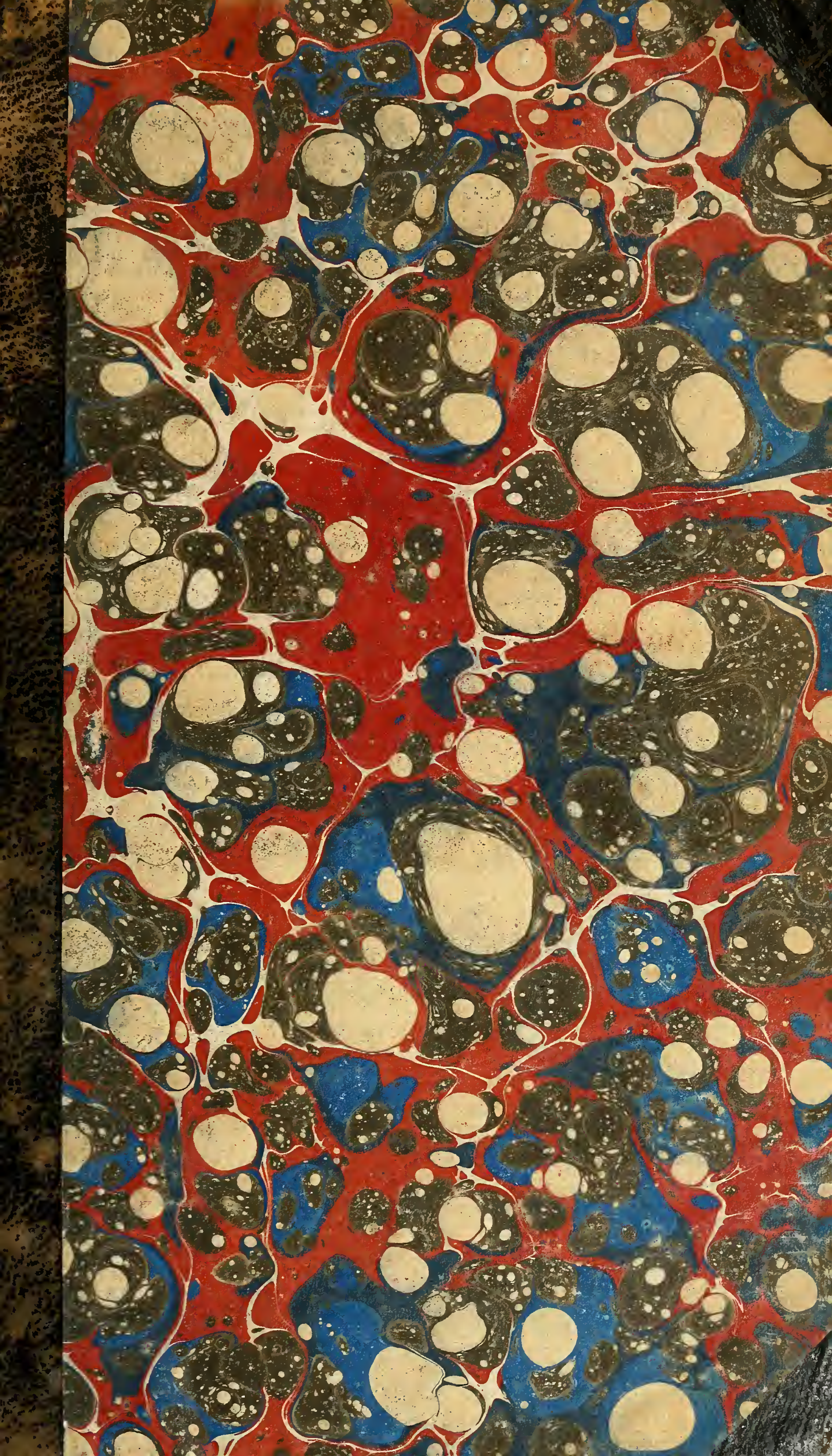

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Mr Paillou
from the autho

PHYSIOLOGICAL
RESEARCHES
INTO THE
MOST IMPORTANT PARTS
OF THE
ANIMAL ŒCONOMY.

DEMONSTRATING,

I. That the preſent Opinion concerning the *Uſe* of the LYMPHATIC SYSTEM is erroneous, and that it does *not* terminate in the THORACIC DUCT.

II. *The Diſcovery* of the great Importance and *Uſe* of the LYMPH, of the LYMPHATIC GLANDS, and of the LYMPHATIC SYSTEM.

III. From the Diſcovery of the Uſe of the LYMPHATIC SYSTEM it is demonſtrated how POISONS, &c. may be either *received* or *prevented* from entering into the Circulation by ABSORPTION.

IV. The *Diſcovery* of the *Uſe* of the BRAIN and its Continuations, its Connection with the NERVES, and with the LYMPHATIC SYSTEM.

BY BENJAMIN HUMPAGE.

LONDON:
PRINTED FOR H. MURRAY, NO. 32, FLEET-STREET;
AND G. MUDIE, EDINBURGH.
1794.

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INTRODUCTION,

SHEWING WHAT ARE THE
PRESENT OPINIONS
CONCERNING THE
LYMPHATIC SYSTEM;
AND
DEMONSTRATING THAT THEY ARE NOT FOUNDED
IN TRUTH.

THE Lymphatic Syſtem within the preſent century has engaged the particular attention of ſome of the moſt learned and ingenious phyſiologiſts: for on this will be found, ultimately, to depend our accurate knowledge of many alterations to which an animal may be ſubject, during health; as well as rightly to comprehend the nature and cauſes of diſeaſes which take place in the animal œconomy, and point out the methods of cure. It will, therefore, appear evident, that the inveſtigation of a ſubject ſo important to mankind, cannot be unacceptable nor undeſerving the moſt ſerious attention.

The lymphatic ſyſtem, although it has been ſo much the object of diſcuſſion, that many very eminent anatomiſts have given a great part of their time and ſtudy to it, with a view to demonſtrate its uſe, yet, as far as I have been enabled to conſider the ſubject, appears to be the leaſt ſatisfactorily explained of any part of anatomy; and the arguments and experiments brought in ſupport of the preſent ſyſtem, are by no means concluſive. This is a fact of which any man may be convinced, who will carefully examine what has been advanced on the ſubject by different authors; where ſo many contradictions and irreconcileable difficulties appear, that even thoſe who advanced them acknowledge their inability of clearing them up.

But of the moſt material part of the ſyſtem, namely, the lymphatic glands, which are placed in vaſt multitudes in moſt parts of the body, it is acknowledged by *all writers*, that their uſe is not known, nor why they exiſt: and as theſe parts are admitted to be an appendage of, and connected with the lymphatic ſyſtem, I do not heſitate to aſſert, that the real uſe of the lymphatic ſyſtem itſelf cannot be *known*, whilſt the uſe of theſe glands remain *confeſſedly unknown*; nor can any ſyſtem be eſtabliſhed, unleſs it can be ſhewn what are the uſes of the lymphatic glands in the lymphatic ſyſtem; as it cannot be ſuppoſed that ſuch a great number of glands can be placed in almoſt all parts of the body, without anſwering ſome very important purpoſe.

Anatomy of late years has been ſo much cultivated, that many parts of the body, which thoſe who have preceded us were unacquainted with, as well as their uſes, have been demonſtrated; and many of the eſtabliſhed ſyſtems have been proved to be founded in error: but notwithſtanding theſe great advantages, every reflecting man muſt be well convinced, that there ſtill remains a great deal to learn; and as long as the uſes of certain parts of the animal œconomy are confeſſedly acknowledged not to be known, it is evident that anatomy is not ſo completely inveſtigated, but that by experiments and obſervations, there may yet be great improvements made, and that it may be brought to a greater degree of perfection than it is at preſent.

It is not my intention to take notice of the different opinions which have been entertained on this ſubject, any farther than to illuſtrate the ſyſtem which I intend to offer; as it would only be a loſs of time to intrude that on the public, which it has already in its poſſeſſion. The controverſies that have ariſen already on the ſubject, have, in a great meaſure, involved it in greater difficulties, and rendered it more obſcure and inexplicable.

I do not, however, here intend to give offence to thoſe gentlemen, who have taken pains to ſupport the preſent opinion of the lymphatic ſyſtem terminating in the thoracic duct, who, perhaps, may conſider it preſumption to endeavour to controvert what appears to be ſo well received, and what, in their opinion, may be indiſputable. They may, perhaps, treat with contempt, any innovation, or endeavour to overturn a doctrine, that is conſidered one of the greateſt diſcoveries ſince the circulation, and what has been the labour of ſo many learned men to eſtabliſh; but however great their authority may be, it will not overturn facts, which are ſtubborn things: and although the inventions or opinions founded on authority, may meet with applauſe for a time, yet, if they are not confirmed by the teſt of truth and future experience, it is a duty which every man owes to ſociety, to point out the error wherever he finds it, and to endeavour to ſhew how it may be corrected, in preference to all other conſiderations: upon this principle alone I am induced to ſubmit the following ſheets for the inſpection of the public.

I am ready to acknowledge that the public has received much benefit and information from the inquiries of the gentlemen who introduced the preſent ſyſtem, and that they are juſtly entitled to the great eſteem and applauſe which have been conferred on them; but ſtill I cannot agree with them in many eſſential points: and where I have been under the neceſſity of differing from them, it has not been from a deſire to diſpute or cenſure what they have advanced, but from a conviction that it originated in error; which in a ſcience, where the life of mankind is immediately concerned, is of too much conſequence to be neglected.

I am conſcious of the great difficulty there is in controverting an eſtabliſhed ſyſtem, and of the oppoſition that may be likely to reſult from ſuch an attempt; but I ſhall only requeſt, in my own defence, that the public will conſider the following ſheets, unbiaſſed, and diveſt themſelves of all pre-conceived opinions or prejudices. It is not my intention to endeavour to influence the minds of men by mere aſſertions, without arguments and proofs to ſupport what I advance; and unleſs theſe appear concluſive,

ſive, I do not wiſh the public to give them more credit than what they may be found on examination to merit.

The preſent received opinion of the lymphatic ſyſtem, with all its improvements, is, that it is a ſyſtem of veſſels, which ariſe from ſurfaces and cavities of every part of the body, and ſuppoſed to terminate in the thoracic duct, which is conſidered the common trunk of the ſyſtem; that its uſe is for the abſorption of fluids from all the cavities and ſurfaces of the body, and to convey them into the blood by means of the thoracic duct. Of the lymphatic glands, which form a very material part of this ſyſtem, and is conſidered by all authors, as we have already obſerved, as an appendage of it, the uſe is not known.

Mr. Hewſon, p. 20, of his Experimental Inquiries, &c. ſays, " That the lymphatic " ſyſtem, beſides the glands, is divided into " three parts, viz. the lacteals, the lymphatic " veſſels, and the thoracic duct; that the " lacteals belong to the inteſtinal tube, "whilſt the lymphatic veſſels belong to all "the other parts of the body, and that the "thoracic duct is the common trunk which "receives both lacteals and lymphatics.

Mr. Cruikſhanks, in his Introduction to the Anatomy of the Abſorbing Veſſels, p. 4, has quoted the following paſſage from the late Dr. Hunter's Introductory Lectures, viz. "I think I have proved that the lymphatic veſſels are the abſorbing veſſels all "over the body; that they are the ſame as "the lacteals; and that theſe all together, "with the thoracic duct, conſtitute one "great and general ſyſtem, diſperſed "through the whole body, for abſorption; "that this ſyſtem only does abſorb, and "not the veins; that it ſerves to take up, "and convey whatever is to make, or to "be mixed with the blood, from the ſkin, "from the inteſtinal canal, and from all "the internal cavities or ſurfaces whatever. "This diſcovery gains credit daily, both "at home and abroad, to ſuch a degree, "that I believe we may now ſay, it is almoſt univerſally adopted; and, if we

“ miſtake not, in a proper time, it will be
“ allowed to be the greateſt diſcovery both
“ in phyſiology and in pathology, that
“ anatomy has ſuggeſted ſince the diſco-
“ very of the circulation.”

But if we examine with attention what Dr. Hunter ſays in his Medical Commentaries, where he claims the honour of diſcovering the lymphatic veſſels to originate from ſurfaces and cavities, terminating in the thoracic duct for abſorption, we may obſerve him ſupporting his claim, by continually endeavouring to reconcile contradictions.

Profeſſor Monro at firſt oppoſed this doctrine, and conſidered the lymphatics as continuations of arteries, which was then the prevailing opinion; but the arguments advanced in favour of the lymphatics being a ſyſtem of abſorbents, were ſo ſtrong and concluſive, that he afterwards adopted and ſupported that opinion, and claimed the diſcovery, in oppoſition to Dr. Hunter; which gave riſe to a controverſy not neceſſary again to revive, as the public are already in poſſeſſion of the arguments advanced in favour of each of the parties. Dr. Hunter, however, having collected letters from ſeveral gentlemen who attended and made notes of his lectures, he publiſhed them in his Commentaries, as ſo many proofs of his having taught, that the lymphatics were a ſyſtem of abſorbents for ſome time previous to the claim of Profeſſor Monro; and that of courſe he had an excluſive right to the diſcovery. As theſe letters convey a clear idea of the prevailing opinions at that time, of the origin and uſe of the lymphatic veſſels, it may be acceptable to ſuch as have not entered particularly into the opinions concerning them, to conſider the arguments and experiments on which the preſent ſyſtem is founded.

One of theſe letters is from Mr. Symonds of Exeter, ſurgeon, who Dr. Hunter, p. 8 of his Commentaries, ſays, attended his firſt courſe of lectures in 1746, and the three following courſes, and likewiſe aſſiſted him in diſſections, and writes to him from Exeter, June 13th, 1759, thus: "I "ſhall endeavour from recollection and the "aſſiſtance of notes taken at your lectures, "to ſet forth the doctrine you taught, con"cerning the lymphatics, the two firſt "years you read:—and then told us, you "thought the lymphatics were abſorbent "veſſels, and that valves are neceſſary "where there is no propelling force.— "When ſpeaking of the teſtis, you told us, "if we made a hole through the tunica "albuginea, broke or bruiſed the tubuli, "we might diſtend the *lymphatics*, by "*blowing into its ſubſtance.*"

Dr. Hunter, in a note on this letter, remarks, that by the ſame means he "after"wards filled the lymphatics in a calf's "ſpleen by *extravaſation.*" He then ſays, page 9, that Mr. Hamilton, profeſſor of anatomy at Glaſgow, who attended his lectures in 1748, and again in 1749, in a letter to him, dated Glaſgow, Nov. 21, 1757, writes to him in theſe words, "From what "I heard in your lectures, and from ſome "converſations with your brother, I learn-

" ed the method of demonſtrating the " lymphatics by blowing into the excre- " tory ducts of the glands and ſubſtance of " the teſtis. I have by me a preparation " which I had from your brother, where, " from an *extravaſation*, a number of " veſſels are filled, which appear to be " lymphatics, and which I keep to de- " monſtrate them. Your demonſtration of " their ſimilarity to the lacteals, I have " adopted ſince I read here; though always " with the candour of owning you as the " author of that, and a number of other " things."

Mr. Watſon, a gentleman of diſtinguiſhed abilities in his profeſſion, lately deceaſed, and formerly a reader of anatomy, and ſurgeon to the Middleſex hoſpital, writes to Dr. Hunter, the 27th of Auguſt, 1760, as follows:—" You could not ſay what was " their *(lymphatics)* preciſe beginning— " you believed they were not continuations " from arteries, but a particular ſyſtem of " veſſels by themſelves, the true abſor- " bents. In ſome ſucceeding courſes, you

" declared you was fully convinced of this,
" *becauſe you had never been able to inject*
" *them.* If continuations of the arteries,
" why not inject them, ſince we do inject
" the lymphatic arteries? You never could
" fill them by injecting the artery, till you
" had made an extravaſation in the cellular
" membrane. You thought them the ab-
" ſorbing veſſels, becauſe they have *valves*,
" as the *lacteals have*, which are known to
" be *abſorbing veſſels*. Why ſhould they
" (lymphatics) have *valves* in the viſcera,
" when the veins have none? which you
" anſwered by obſerving, that lacteals have
" no impetus from the arteries as the veins
" have; therefore they are furniſhed with
" valves."

" You told us—you had traced the lym-
" phatics from the teſtis of a dog into the
" thoracic duct. You informed us, the
" lymphatics might be demonſtrated either
" by *blowing* into the *artery*, or by making
" a ligature on the emulgent vein in a
" living dog; for in each way they will
" be diſtended: but you obſerved at the

" ſame time, that theſe *experiments* were *no*
" *proofs of their being continued from ar-*
" *teries*, as the caſe might be the ſame as
" in injecting. You produced before us,
" a preparation of the teſtis from a horſe,
" in which the artery was injected red;
" and the lymphatics dried hollow, diſ-
" tended with air, which you told us had
" been thrown into them by inflating the
" cellular membrane."

Dr. D'Urban, in a letter from Richmond, Nov. 12, 1757, ſays, " I have been look-
" ing into the notes I made from your lec-
" tures in the beginning of the year 1749,
" and ſhall tranſcribe the paragraph juſt as
" it ſtands.

" LYMPHATICS.] A preparation of the
" lymphatics of a horſe's teſtis. I do not
" believe them continuations of the ſeri-
" ferous arteries, but abſorbent veſſels
" placed in every interſtice of the body,
" which take up any fluid, thrown into
" the abdomen or any other cavity; as is
" ſeen from daily experience. I have in-
" jected

" jected the ſpleen, which is full of lym-
" phatics, with the moſt ſubtil injections,
" filled every branch of the artery or vein,
" when after tying the vein, and forcing
" the injection till the veſſel burſt, imme-
" diately on the *extravaſation* the lympha-
" tics became filled. This I have tried
" more than once with the ſame ſucceſs.
" *Hence I conclude they are not a continu-*
" *ation of, nor have any communication*
" *with, the arteries.*"

Dr. Smith, reader of anatomy at Oxford, gives the following extract from notes taken at Dr. Hunter's autumn courſe of lectures, 1750. " If you *blow or throw water into*
" *an artery or vein* in the liver or ſpleen,
" &c. you can raiſe the *lymphatic veins:*
" hence alſo they were thought to be con-
" tinuations of the lymphatic arteries; but
" I doubt it, for on injecting the ſpleen, I
" could not throw the injection into the
" lymphatics till the artery was ruptured,
" and then it got into the lymphatic veſſels.
" Beſides, why ſmall valves in the lym-
" phatics, if veins, *when other veins of the*

"*abdomen have none?* They ſeem to be "abſorbents of a fine fluid to be con- "veyed into the *receptacle of the chyle, for* "*dilution*, &*c*. We find the lacteals, "which are allowed to be abſorbents, "have *valves*; and the reaſon is, that on "the leaſt motion, the progreſſive circula- "tion may be accelerated. The lympha- "tics, therefore, ſeem to begin from cells "and ſurfaces."

Dr. Hunter, page 13, relates, that Mr. Davenport, of Norfolk Street, attended his courſe of October, 1751, and ſeveral ſucceeding courſes, and gives the following literal tranſcript of notes, which he took down in that firſt courſe:

"Some aſſert that theſe lymphatic veſſels "alſo originally take riſe from the ex- "tremities of arteries; which they tell "you, may be proved in the dead ſubject "by tying the vein, and then inflating the "artery, as they enter the ſpleen or kid- "ney, for inſtance; or in the living, by "making your ligature; either of which

“ methods, ſay they, will make theſe veſ-
“ ſels very conſpicuous. But, *both theſe*
“ *experiments are fallacious, and prove no-*
“ *thing*; for this appearance never comes
“ out in either, till the air or fluids have
“ made themſelves a paſſage, by deſtroy-
“ ing other tender parts that naturally op-
“ poſed them.”*

---

* Dr. Hunter, in a note on this letter, obſerves, that Profeſſor Monro (page 20, 21) by way of introduction to his ſubject, tells us, the arguments by which former anatomiſts were perſuaded that the lymphatics were continuations of arteries, (particularly air, water, and quickſilver paſſing readily from the arteries into them,) and then adds, “ Without therefore ac-
“ counting in ſome other way for theſe experiments,
“ and refuting the arguments drawn from them, to
“ propoſe a contrary opinion as a remarkable diſco-
“ very, is certainly betraying a very weak and preci-
“ pitate manner of hurrying to concluſions, contra-
“ dicted by premiſes.” Dr. Hunter then ſays, that he accounted for theſe experiments in another way, viz. by *extravaſation*, and that Dr. Monro did the ſame ſeveral years afterwards: he then adds, “ I will
“ truſt the reader for ſeeing the force of this, and now
“ beg of him to read Dr. Monro, from page 50 to the
“ end of the chapter: but leſt he ſhould not be able to
“ give himſelf that entertainment readily, from not

Mr. Davenport then ſays, that the following was an additional note, taken at a ſubſequent lecture, to the beſt of his recollection and belief, in the year following, viz. 1752.

"As the veins called Bartholine's lym-
"phatics are too minute to be traced to

"having Dr. Monro's pamphlet immediately at hand,
"I will do him the pleaſure of tranſcribing one pa-
"ragraph, (from p. 53.) 'I have, however, clearly
'proved,' ſays the Profeſſor, 'that Dr. Hunter never
'had ſhewn any preparations, nor made experiments
'on the lymphatics, from which any concluſion re-
'lating to their origin could poſſibly be drawn; and
'that ſo far from *pretending* to explain or refute the
'experiments of Nuck, Cowper, Liſter, &c. in
'proof of lymphatic arteries, he never ſo much as
'mentioned them. Conſequently, Dr. Hunter's pre-
'tenſions to even the ſmalleſt ſhare of what he is
'pleaſed to call, (which, by the bye, I never did) *the*
'*important diſcovery, that the valvular lymphatic veſſels*
'*are a ſyſtem of abſorbent veins*, are evidently founded
'on *a declaration* or concluſion contradicted by pre-
'miſes. And this concluſion, ſo far from meriting
'praiſe, can only be ſaid not to deſerve cenſure, on
'the ſuppoſition, that he was ignorant of what had
'been done on the ſubject."

“ their origin, anatomiſts are not agreed “ from whence they ariſe. The generality “ take them to be continuations of ſmall “ arteries; and their *proofs* are by no means “ *trivial*, if it be true, (as is aſſerted) that “ by making a ligature upon the vein pro“ceeding from any gland, you will ſee the “ *lymphatic veſſels* of that *gland greatly* “ *diſtended*, as of the kidney for example. “ And they tell us too, that by driving “ air into an artery in the dead ſubject you “ inflate theſe veins; and thus demonſtrate “ the truth of this doctrine. Notwith“ſtanding theſe ſpecious arguments, how“ever, Mr. Hunter is clearly of opinion, “ that theſe veins are rather the abſorbents “ ariſing from all the different cavities of “ the body, as the veſica urinaria, fellis, “ veſiculæ ſeminales, &c. &c. A ſtrong “ preſumptive argument, at leaſt, in ſupport “ of this notion, is the cloſe analogy they “ in many circumſtances bear to the lacteals; “ for theſe riſe like the lymphatics, have “ little elſe than the kneading motion in reſ“piration to promote the progreſs of the “ chyle, and are furniſhed with valves at

" due diſtances, that the chyle may be al-
" ways ſure of paſſing on to the recepta-
" culum chyli, and ductus thoracicus;
" the ſame place of termination have all
" the lymphatics: in like manner are theſe
" provided with innumerable little valves;
" their coats are thin and fine as the lac-
" teals; they anaſtomoze frequently like
" them; and, in ſhort, ſeem in nothing
" to differ from each other, but in the na-
" ture of the fluids they convey, &c."

Mr. Davis, of King-ſtreet, Covent Garden, ſurgeon, ſays that the following is a literal extract of the notes he made when he attended Dr. Hunter's courſe of lectures, January 1750-1: "ſpeaking of the lym-
" phatics; according to Mr. Hunter, their
" origin is more probably from all the ca-
" vities and interſtices of the parts of the
" body. From the common method of
" raiſing them in the ſpleen and teſtes;
" from analogy with the lacteals. Hence
" Mr. Hunter will have them to be the ab-
" ſorbents." He farther ſays, "As this was
" the firſt courſe of anatomy that I had at-
" tended,

“ tended, I was not able to write my notes
“ ſo fully; in the next courſe, (to wit, in
“ October 1751) I find that, upon the ſub-
“ ject of lymphatics, I have been a little
“ more particular. My notes begin thus:
“ There are two kinds of lymphatic veins;
“ the one kind, are thoſe in which the
“ lymphatic arteries terminate, and whoſe
“ contents go with the blood, as thoſe of
“ the other veins into the heart; the other
“ kind are the lymphatics of Bartholine,
“ which are, &c. After the deſcription
“ of them in my notes, comes this para-
“ graph: Mr. Hunter's own private opi-
“ nion, that theſe lymphatics of Bartholine
“ are nothing but the true abſorbents of the
“ body; and that they have their origin
“ from all the cavities, ſurfaces, and inter-
“ ſtices, of the parts of the body: his rea-
“ ſons are, 1. The common method of
“ raiſing in the ſpleen and teſtes with a
“ blow-pipe, which could never raiſe the
“ other lymphatics. 2. Theſe lymphatics
“ of Bartholine have valves in the viſcera;
“ whereas, no other veins in the viſcera
“ have valves. 3. Theſe lymphatics are

“ never injected from the arteries. 4. The
“ analogy they bear to the lacteals, which
“ have alſo valves. 5. Theſe veſſels end,
“ for the moſt part, (if not all of them) in
“ the thoracic duct or route of the chyle;
“ whereas, the other lymphatics end in the
“ blood veſſels.”

Mr. Galhie, of Spital-ſquare, in a letter to Dr. Hunter, writes thus:—“As I attended your lectures ſo early as the year “ 1751, I ſhall, agreeable to your deſire, “ tranſcribe from my notes, what you then “ declared as your opinion, with regard to “ the origin and uſe of the lymphatic veins. “ That they were not continuations of the “ arteries, as generally believed, but abſorbing veſſels; beginning imperceptibly “ from the different cells and ſurfaces of “ the body, you was fully perſuaded, “ 1. Becauſe you could not inject them as “ other veins, by filling the arterial ſyſtem. “ 2. In injecting, you ſometimes obſerved, “ that they were ſuddenly filled, when the “ arteries burſt and the injection was effuſed into the cellular membrane; a circumſtance, which you imagined ſuffi-

" ciently explained, and refuted thoſe ana-
" tomiſts who pretended to have filled the
" lymphatics directly from the arteries or
" veins. 3. As a farther confirmation of
" this doctrine, you mentioned the valvu-
" lar ſtructure of the lymphatic veſſels, not
" obſervable in the other veins of the viſ-
" cera; the great likeneſs of the lymphatics
" to the lacteals, in their coats, valves,
" courſe, and terminations, and laſtly, the
" abſorption and progreſs of the venereal
" poiſon, and inoculated matter of the
" ſmall-pox."

Several other letters might be produced in ſupport of the ſame ſyſtem, but as it would only be a repetition of the ſame opinions, it is not conceived neceſſary.

The contradictions in the preceding letters are ſufficiently apparent. We are told, that the lymphatics are *not* continuations of arteries, becauſe, they aſſert, that they *cannot* be injected from arteries: we are then informed, that the lymphatics *are* continuations of arteries, becauſe they *can* be injected from arteries: we are then to believe that air, water, or other injections, paſſing from the blood veſſels into the lymphatics, are *no proof* of their being continuations of arteries, becauſe the injections paſſed in conſequence of *extravaſation*. Now what is the uſe of injections, if they are not to be depended on, in caſes that are evident to the *ſenſes*, and that have been ſo often repeated? And may not the argument of *extravaſation* be advanced, to controvert every experiment or diſcovery that has been made by injection? We may with equal propriety aſſert, that injections are extravaſated that paſs from the veins into the arteries; or, on the contrary, from the arteries into the veins, as to aſſert that water, thrown into the blood veſſels, paſſing into the lymphatics, is the effect of *extravaſation.*

It is very unſatisfactory to tell us, that the mere throwing water into the arteries could cauſe a rupture. I would ſubmit to the reader's conſideration, whether he can conceive, that the rupture of an artery could be produced by ſuch a cauſe; for if this were true, an artery muſt be very ill adapted to retain the blood in living animals, it being continually propelled with conſiderable force, without either producing rupture or extravaſation; which cannot therefore be admitted.

Dr. Hunter is likewiſe certainly in an error, when he aſſerts, that the veins of the viſcera have *no valves*, for the reverſe is the fact. The veins are abundantly ſupplied with valves, as may be ſeen by examining the veins from the ſpleen, pancreas, kidneys, renal, and proſtate glands, as well as in moſt other parts of the viſcera. The reaſon that Dr. Hunter denied valves to the veins of the viſcera, is ſufficiently obvious; he conſidered the valves as a criterion by which to diſtinguiſh abſorbent veſſels, and were abſolutely neceſſary to them in order to perform their office of abſorption; *and from not comprehending their uſe*, he has been led into errors, as well as miſleading others. He conceived that, if he admitted the veins were ſupplied with valves, it would be brought as an argument againſt him, of their abſorbing; and ſupply the ſupporters of venal abſorption, with an argument advanced by himſelf; namely, that veſſels with valves are abſorbent veſſels, which he ſuppoſed were peculiar to them alone, and which is not the fact.

Since then it appears that he has not heſitated to remove any obſtacles that have been in the way of his ſyſtem, whether *right* or *wrong*, we may certainly have reaſonable grounds to ſuſpend our aſſent to what he advances with reſpect to *extravaſation*, particularly as the arguments in its ſupport are very far, in my opinion, from being either ſatisfactory or concluſive.

I can, however, by no means admit, that the experiments produced, do prove the lymphatics to be a ſyſtem of veſſels ariſing from ſurfaces and cavities, and that they terminate in the thoracic duct; and that there is no other channel or paſſage for abſorbed fluids into the blood: for this is evidently the principal point which all the ſupporters of this ſyſtem have been aiming at, and on which it muſt ultimately depend; and what has been always conſidered as eſſentially neceſſary to eſtabliſh, before their ſyſtem could be received. How will they be able to reconcile the many objections and difficulties that evidently appear ſo very contradictory; ſeveral of which they themſelves acknowledge to be ſuch? I ſhall beg leave to mention a few of them from Mr. Cruikſhanks, as he avails himſelf of all the arguments and experiments of others, as well as of his own, that can be brought in favour of this ſyſtem.

He ſays, page 44, in his Anatomy of the Abſorbing veſſels, that "Watery fluids "thrown into the arteries, veins, or excretory ducts of the glandular viſcera, very "commonly *get into the lymphatic veſſels*, "which then becoming viſible, punctures "may be made in the ſmall branches, and "the watery fluids be forced out or diſplaced by injecting quickſilver." The mere throwing watery fluids into the blood veſſels ought certainly not to fill the lymphatic veſſels, if they originated from ſurfaces and cavities, and terminated in the thoracic duct. If there be no natural paſſage, as is aſſerted, from the blood veſſels into the lymphatics, the fluids evidently could not go into them. Again, he farther obſerves, p. 45, that "one of the beſt me-"thods I have found was, previouſly in-"jecting the arteries and veins of the part, "where I wiſhed to ſee the lymphatics, "and then throwing it into water, to ma-"cerate for ſome days: as ſoon as a cer-"tain degree of putrefaction takes place, "air is let looſe in the cellular membrane, "from whence it gets into the orifices of "the lymphatics, and uniformly fills their "branches. In this way I firſt diſcovered "them on the heart and in the uterus; "punctures may be then made in the "ſmaller branches, and the air may be "forced out by an injection of quickſilver." And he farther adds—"I muſt here ob-"ſerve, however, that in employing this "method, it will ſometimes be neceſſary "to inject, previous to the maceration, "ſeveral ſets of veins, and perhaps ſome "other ſpecies of veſſel alſo, before it can "be fairly inferred that any new veſſel fil-

" ling itſelf with air was a lymphatic. Were
" one to ſet about diſcovering the lympha-
" tics of the liver in this way, he muſt in-
" ject previouſly the hepatic artery, then the
" vena portarum, then the venæ cavæ hepa-
" ticæ, and other ſmaller veins entering the
" cava, but not properly branches of the
" former. When he has done this, he muſt
" alſo inject the ductus hepaticus, and its
" branches, the pori biliarii, before he
" could infer that any new veſſel filling it-
" ſelf with air, in conſequence of macera-
" tion of the viſcus in water, was a lym-
" phatic. I muſt, however, obſerve, that
" on the extremities this method cannot be
" employed, as the valves prevent us from
" injecting the veins, unleſs on ſome lucky
" occaſion, where they are now and then
" injected from the arteries, as continued
" but reflected tubes, and in the courſe of
" the circulating blood." He farther obſerves, that " when a proper limb has been
" procured, I make ligatures on the top of
" the foot or back of the hand, and, by
" repeated ſtroking of the toes or fingers,
" force the brown fluid in the extreme
" branches

" branches of the lymphatics into larger " branches: the ligatures prevent it from " being drove on, and the veſſels gradually " become diſtended cloſe by the ligature." He alſo obſerves, that the method of diſcovering the lymphatic veſſels, in the legs and arms, is by puncturing a gland, and the tube filled with quickſilver, inſerted into the opening, or the tube may be puſhed at once into the ſubſtance of the gland, which will ſucceed equally well; or if a puncture had been previouſly made, the mercury then fills the lymphatics; and he even recommends the thoracic duct itſelf to be injected by this means.

The injecting the arteries and veins of the part where the lymphatics are to be diſcovered, does not corroborate the opinion of their originating from ſurfaces, and terminating in the thoracic duct, or that they are diſtinct or ſeparate from the blood veſſels, as is imagined.

I do not conſider that the lymphatics were filled from air that is let looſe into the cellular membrane, but, on the contrary, that the cellular membrane is filled with air, by its paſſing from the putrid fluid in the blood veſſels, through the lymphatic glands and veſſels, and ſo into the cellular membrane. The fluid becomes brown, I ſhould preſume, from the blood being putrid, and mixed with the water that had been previouſly injected into the blood veſſels; and that in preſſing it into the lymphatics, it had paſſed from the blood veſſels into them, and not from the cellular membrane.

But if the thoracic duct be the trunk of the abſorbent ſyſtem, why not inject that, and ſo fill the whole of the lymphatic ſyſtem at once, as we do the blood veſſels from their trunks? This certainly would be preferable to the injecting fluids into the blood veſſels and glands. Perhaps it may be ſaid, that injections will not paſs through the minute glands, ſo as to fill the ſyſtem; but this cannot be admitted as an objection, becauſe, if we ſuppoſe that a fluid ſo thick, as the lymph is frequently found to be, can be perpetually abſorbed and paſs through ſuch a multitude of glands, from the extreme parts of the body, it would certainly appear reaſonable to ſuppoſe, that ſo volatile a fluid as mercury is, if injected into the thoracic duct, would fill the whole of the lymphatic ſyſtem.

Mr. Cruikſhanks ſays, p. 49, "In animals ſtrangled, or dying of ſome violent "death, the lymphatics about the ſpleen, "and in the cavity of the abdomen in general, are almoſt always found turgid "with blood, though I have never ſeen, "on theſe occaſions, any marks of extravaſation of that fluid into the cellular "membrane. In peritoneal inflammation, "I have demonſtrated the lacteals full of "blood, though in this inflammation there "is little or no ſwelling, of courſe no extravaſation of blood into the cellular "membrane. I have ſeen the abſorbents "of the lungs alſo loaded with blood, in "the peripneumony or inflammation of "their ſubſtance; and on all theſe occaſions "have been induced to believe, that the "lymphatics aroſe from the internal ſur-

" face of arteries and veins. This opinion
" is not without its difficulties; for arteries
" and veins have been diſtended with in-
" jected fluids on many occaſions, without
" the ſmalleſt drop of theſe fluids paſſing
" into the lymphatics; and one of the ar-
" guments, by which the origin of the
" lymphatics from ſurfaces is ſupported, is,
" that they cannot be injected from arteries
" or veins. On the other hand, there is no
" anatomiſt, who has been at all converſant
" in injecting arteries and veins, but on
" ſome occaſion or another muſt have
" found, that from theſe he had alſo in-
" jected the lymphatics."

How very contradictory this appears: If the lymphatics originate from ſurfaces, how can they originate from the arteries? And if they originate from the blood veſſels, how is it poſſible that they can originate from ſurfaces, as is here conjectured?

As the lymphatics of the ſpleen, as well as the lymphatics from the glands of the other parts of the abdomen, are found turgid with blood from violence without any marks of extravaſation, there is no doubt but it muſt come through the glands, from the blood veſſels. Mr. Cruikſhanks' idea of the lymphatics ariſing from the arteries is certainly a juſt one; for thoſe effects which he mentions, could not happen unleſs they did ſo; but yet I do not agree with him when he ſays, that the arteries and veins have been diſtended with injected fluids, without the ſmalleſt drop paſſing into the lymphatics; and, beſides, this evidently diſagrees with what he ſays in another part of his book, which I ſhall notice preſently. I know well the argument by which the lymphatics, ariſing from ſurfaces, is ſupported; namely, that they cannot be injected from arteries or veins; but I hope to make it appear, that this opinion is founded in error, and that, on the contrary, they can be injected from arteries or veins; and that this fact has been endeavoured to be controverted, ſolely with a view to make the lymphatics a ſyſtem of veſſels, terminating in the thoracic duct, in oppoſition to the experiments that have been advanced by many of the firſt and moſt eminent phyſiologiſts, who have aſſerted, that they have injected the red veins from ſurfaces and cavities in many parts of the body: and one is particularly related by the celebrated Kaau Boerhaave; he injected water into the ſtomach and inteſtines of a dog, which being compreſſed, he ſaw the water run into the meſenteric veins in ſuch quantities, as to waſh out the red blood, ſo that the veins appeared white.

Now, in oppoſition to the experiments that have been made, to prove this direct paſſage into the blood veſſels, many others have been made to prove that there is no paſſage, from ſurfaces or cavities, for abſorbed fluids into the circulation, except by means of the thoracic duct. The late Mr. John Hunter made many experiments in ſupport of this opinion; but it ſhould be recollected, that he, perhaps, might be conſidered a little partial in theſe experiments, particularly as his brother, the late

Dr. William Hunter, claimed the honour of diſcovering the lymphatic ſyſtem to originate from ſurfaces or cavities, and terminate in the thoracic duct; and therefore the *reſult* of his experiments *was to prove*, that there was no paſſage for fluids into the veins, except by the thoracic duct. He, however, admits, page 45, of the Medical Commentaries, publiſhed by his brother, that on "June 22, 1759, we repeated moſt of "theſe experiments on another ſheep, to "ſee if the effect would be the ſame; but "in this animal the viſcera were diſeaſed, "inflamed, and thickened in moſt parts, "ſo that the experiments were much leſs "ſucceſsful, leſs ſatisfactory, and concluſive." (*That is, the injections paſſed into the inteſtines from the blood veſſels.*) He then obſerves, that "after injecting milk "into the meſenteric artery for ſome time, "and allowing it to return by the vein, we "opened that part of the *inteſtine*, which "had been *previouſly emptied*, and found "in it a *watery fluid* of a *whitiſh caſt*, as if "a few drops of milk had been mixed with

" it." And he farther obſerves, p. 46, of another experiment, that " after the animal was *dead*, I blowed into a meſenteric vein, and the *air* found a *paſſage* into the *cavity* of the *gut*, though in making the experiment when the animal was alive, I could not force the milk by injection from the vein into the gut."

Mr. Cruikſhanks ſelects ſeveral of theſe experiments: they were made on the inteſtines and meſentery of ſeveral different animals, which were frequently repeated in various portions of the inteſtinal tube, in each animal, at the ſame time. After portions of the inteſtines had been emptied of their contents, ligatures were made on the trunks of the arteries, to prevent any freſh ſupply of blood; whilſt punctures were made in the trunks of the veins to let out what blood they contained; milk and different coloured fluids were then injected into the inteſtines, which, after remaining there for ſome time, the reſult was, that it did not appear that any of the fluid had got into the veins; and in ſome of the experiments, a conſiderable degree of preſſure was uſed, even ſo as to burſt the inteſtines, yet it did not appear that the ſmalleſt drop of the fluid had got into the veins. It was conjectured that the eye might be liable to be deceived, and that the ſmell might detect the fluid, if any paſſed into the veins: therefore, fluids were impregnated with muſk, and injected into the inteſtines, prepared as before; but on examining the blood from the meſenteric veins, there was not the leaſt ſmell of muſk.

Mr. Cruikſhanks however obſerves, in the laſt experiment he mentions on this head, p. 24, that "*after one of the animals* "*was dead,** *the meſenteric veins were in-* "*flated*

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* It is the general received opinion, that, when animals are dead, fluids injected into the veins, tranſude into the cellular membrane, &c. or fluids injected into the meſenteric veins, will tranſude into the inteſtines, and the ſame in other parts of the body; not through paſſages that were natural to the animal whilſt living, but by ſuch as are ſuppoſed to be the conſequence of tranſudation in the dead one: but as theſe fluids paſs into

" *flated with air, which, though a very* " *viſcid fluid, found its way into the cavity* " *of the inteſtines;* though milk, injected " through the ſame veins, while the animal " was alive, could not be forced into the " ſame cavity." He then ſays, that " theſe " experiments appear to me perfectly con" cluſive." Now, if we admit that theſe experiments do prove that there is no paſſage for fluids into the blood, except by means of the thoracic duct; for this is the grand point which they are intended to eſtabliſh, what muſt we ſay to the following obſervation that he makes, or how can we reconcile it? He ſays, p. 65, " *Wherever a lymphatic veſſel enters a vein, there is always a* " *valve, and moſt commonly a pair, to pre-* " *vent the blood from paſſing from the vein* " *into the lymphatic veſſel.*" And he farther adds, that " in the red veins we ſometimes " meet with three or four valves, inſtead of

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into the different parts of the body in dead animals, they will certainly go through the ſame channel in living ones; for I do not admit that tranſudation either takes place in the living or dead body: but this ſubject will be particularly conſidered hereafter.

two,

“ two, in one place; *and frequently where*
“ *a lymphatic enters a red vein, there is but*
“ *one valve.*”

Now does not this acknowledge a direct paſſage from the lymphatic veſſels into the blood veſſels, independent of the thoracic duct? It certainly admits that there is a direct paſſage into the blood veſſels, and from all parts of the body; for if a lymphatic enters a vein in one part, it muſt, from analogy, be the ſame throughout the animal. This being admitted, it immediately acknowledges the accuracy and juſtneſs of the experiments advanced in favour of this paſſage into the blood veſſels; and, at the ſame time, it completely overturns all the experiments that have been advanced to controvert it: and will it not be abſolutely fair to infer, that it is impoſſible that the thoracic duct can be the trunk or termination of the lymphatic ſyſtem?

It will therefore appear, that the lymphatic ſyſtem does not terminate in the thoracic duct, from what has been already obſerved, as well as from the following obſervations :

1. If we conſider the nature of a gland, whoſe component parts are made of arteries convoluted, which is to ſecrete fluids from the blood; for example, the ſalivary glands, ſecrete ſaliva; the lachrymal glands, tears; the cutaneous glands, the perſpirable matter; the liver, bile; the kidneys, urine; the teſticles and ovaries, ſemen, &c. Now all theſe glands have excretory ducts to convey their fluids, from the blood to the various parts of the body, from whence, in a ſtate of health, they are diſcharged, after they have performed their office; this is admitted by all anatomiſts to be the fact; why ſhould we then reverſe this general order, and aſſert that the lymphatic and lacteal veſſels paſs through ſuch a multitude of glands as are diſperſed throughout the body, in order at laſt to get to the thoracic duct, to convey fluids into the blood; when we know that all the glands, whoſe uſes are at preſent known, is to convey fluids *from* and not *into* the blood; and that of courſe

there can be no ſubſtantial reaſon for aſſerting, that the lacteals and lymphatic veſſels paſs through theſe glands, for the purpoſe of conveying fluids into the blood by means of the thoracic duct.

2. Poiſons, ſuch as the venereal virus, the bite of mad or venomous animals, inoculation, the abſorption of matter from an abſceſs, ulcer, iſſue, bliſter, and a variety of ſtimulating medicines, in many inſtances, produce dreadful effects, ſuch as ſwellings, inflammation, and frequently ſuppuration of the neighbouring glands, from whence the matter was abſorbed, and the parts are ſometimes totally deſtroyed, if the matter is of a very malignant nature, which very often is the caſe: a bliſter applied to the back will often produce an inflammation of the bladder. Theſe are facts which occur in almoſt every day's practice; now if we conſider the thoracic duct as the trunk, or termination of the abſorbing ſyſtem, and that there is no paſſage for theſe abſorbed poiſons into the blood, except through the thoracic duct, it would be

certainly fair to infer, that the thoracic duct itſelf ſhould be ſubject to the ſame or ſimilar diſeaſes, to which the other parts of the ſyſtem are liable, which muſt deſtroy the perſon ſo affected; but this does not take place; for a perſon may have all the ſymptoms of an abſorption of poiſon, and even where the glands are in a ſtate of ſuppuration, ſuch for inſtance as a venereal buboe; and even the neighbouring glands will ſwell and inflame, yet there is no ſymptom or appearance of the thoracic duct being affected. Mr. Cruikſhanks has been conſcious of this fact, and he very candidly ſays, page 77, "why the glands in the ca-"vity of the abdomen do not inflame and "ſuppurate on theſe occaſions," (meaning from the abſorption of poiſons, &c.) "I "do not know, but it is very fortunate "they do not; for if they burſt into the "cavity, ſuppuration of the cavity would "be the conſequence, and the patient "would almoſt certainly be cut off." And ſpeaking of the external iliac glands, page 123, part ii. ſays, "Though the venereal

“ poiſon muſt paſs through theſe glands in “ its way to the blood, I know of no inſtance of their ever forming buboes; and “ it is very fortunate they do not, for if “ theſe, like the inguinal glands, ſuppurated, they could not be opened by the “ lancet, they muſt be left to themſelves— “ might burſt; the pus might fall into the “ cavity of the abdomen; might produce “ peritoneal inflammation, and might probably deſtroy the patient. It is very “ difficult to aſſign any reaſon for this, as “ cancerous matter not only affects the firſt “ glands it enters, but all the glands that “ lie between the ſore and the thoracic duct, “ ſome have aſſigned as a reaſon for the “ venereal virus not affecting the ſecond “ glands as well as the firſt; that the poiſon was diluted by being mixed with the “ lymph in the firſt gland. This is by no “ means ſatisfactory, ſince even after it has “ been mixed with the whole maſs of blood, “ it is capable of producing ulcers in the “ throat, blotches on the whole ſurface of “ the body, and caries in the bones.”

Now it is impoſſible, or at leaſt very improbable, that the abſorbing ſyſtem can terminate in the thoracic duct; for as Mr. Cruikſhanks very juſtly obſerved, that when any poiſons were abſorbed, the glands might ſuppurate in the cavity of the abdomen and thorax, and an inflammation of the peritoneum, pleura, and mediaſtinum, and even ſuppuration of thoſe parts might, and would in all probability be the conſequence; ſo that whenever any poiſons were abſorbed, there would be inevitable danger, not only of thoſe important parts being deſtroyed, but alſo of the thoracic duct itſelf, and all the glands that are connected with it, which muſt certainly deſtroy the patient.

The effects of cancerous, ſcrophulous, ſcorbutic, and venereal matter, are not confined to "the glands that lie between the "ſore and thoracic duct;" but extend frequently to parts that are ſituated above the thoracic duct, and every other part of the body. I have ſeen inflamed and frequently indurated glands on the top of the head;

and even the brain has frequently been found to be ſubject to all or moſt of the diſorders to which the lymphatic glands of the other parts of the body are liable; particularly in thoſe perſons who have been ſubject to venereal, cancerous, and ſcrophulous diſorders.

3. It frequently happens, that matter is carried from the head to the extremities; now, if we conſider the abſorbents as a ſyſtem terminating in the thoracic duct, by what means can this matter be tranſlated from the head to the extremities? it cannot be, according to the preſent ſyſtem, by the lymphatics, becauſe they are conſidered as ariſing from cavities and ſurfaces, and that they convey their fluids from the extremities upwards through the abdomen, thorax, and at laſt into the blood, through the thoracic duct; and of courſe, in a direction diametrically oppoſite to the tranſlation of matter from the head to the extremities.

4. The thoracic duct cannot be the trunk of the abſorbent ſyſtem, from the ſmallneſs

of its ſize; it is indeed ſo ſmall, that it would appear to be impoſſible to receive the fluids, which are ſuppoſed to be abſorbed by ſuch a multitude of veſſels; one of which in many parts of the body is ſeveral times larger than the thoracic duct; now when we conſider what a number of lymphatic veſſels there are in the body, that are larger than the thoracic duct, it muſt be ill-adapted to anſwer the purpoſe that is at preſent aſſigned to it. One would conceive it impoſſible, or at leaſt very improbable, to be capable to convey through ſo ſmall a channel, ſuch a quantity of fluid, as ſo many veſſels muſt preſent to it.

Mr. Hewſon, page 68, ſpeaking of the lymphatics of birds, ſays, "The lymphatics of the neck generally conſiſt of two "pretty large branches on each ſide of the "neck, accompanying the blood veſſels. "Thoſe two branches join near the lower "part of the neck; and the trunk is in "general as ſmall, if not ſmaller, than "either of the branches." And again, page 96, ſpeaking of the lymphatics of fiſh. "This ſyſtem agrees with that of turtle,

" in having a very large receptaculum, and
" in having the net-work of large veſſels
" near its termination in the ſanguiferous
" ſyſtem; and likewiſe in *having the veſ-*
" *ſel, which goes from the net-work into*
" *the vein, ſmall in proportion to the ſize of*
" *that net-work*: ſo that the lymph muſt
" be lodged ſome time in thoſe parts
" before it is poured into the maſs of
" blood."

If we admit that the trunk of the lymphatic ſyſtem is only a ſmall branch, in proportion to that net-work which is ſituated near it; how ill-adapted muſt the thoracic duct be, for the purpoſe of conveying the abſorbed fluid into the blood from that net-work, compoſed of ſuch a multitude of veſſels, one of which is much larger than the trunk or thoracic duct itſelf? and particularly when we conſider what a vaſt number of theſe net-works there are diſtributed in all other parts of the body: ſo that when joined together, one would apprehend *that a ſmall ſingle branch from one of the net-works could not poſſibly be the trunk or termination of a ſyſtem, ſo generally extended all over the body.*

Mr. Cruikſhanks, page 77, ſays, "I "have injected fourteen vaſa inferentia on "the thigh belonging to the ſame gland, "and have no doubt of there being four "times that number belonging to the gland "which were not injected. To all of "theſe, one vas efferens only correſponded, "which went out of the gland on the op-"poſite ſide. The vas efferens goes out of "the gland in the ſame manner that a vas "inferens enters it, that is, by ſhort, ex-"tremely minute, radiated beginnings. "The vaſa efferentia are generally larger "in ſize than the vaſa inferentia. I have "ſeen ſome of theſe as large as the thora-"cic duct itſelf." And page 87, he obſerves, that "one of the trunks of the lym-"phatics of the lungs, which I had in-"jected with quickſilver, was twice the ſize "of the duct, as it lay behind the root of "the lungs on the ſpine. Two of the "trunks of the abſorbents in the lungs of "an ordinary ſized turtle were each of "them as large in diameter as the cava ſu-"perior in the human ſubject, and ten

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“ times the ſize of the thoracic duct they
“ belonged to, if the receptaculum chyli
“ be excepted.”

Now, as it is a fact well-known, that branches of the lymphatic ſyſtem are found in moſt parts of the body many times larger than the thoracic duct itſelf; if we admit what Mr. Cruikſhanks advances, that he injected fourteen of the vaſa inferentia on the thigh belonging to the ſame gland, and that there is four times that number, (and it is very probable that there might be a much larger quantity, for they are very numerous,) belonging to the ſame gland uninjected; is it not very extraordinary that one veſſel only, the vas efferens, ſhould be ſuppoſed capable to contain all the fluid brought by ſo many veſſels, one of which is as large as itſelf, and perhaps even larger than the thoracic duct? And then, that this veſſel ſhould convey its fluid to the next neighbouring gland, to paſs through the ſame courſe, all through the abdomen and thorax?

This appears ſo very obſcure and complex, that it would induce one to believe it impoſſible, particularly when we conſider the minute texture of theſe glands, and the number of them ſo great, that the fluid would be ſo much impeded in its paſſage, that it could ſcarcely ever arrive at the thoracic duct; and even if it did, the fluid would not find a paſſage, from the ſmallneſs of the trunk of the thoracic duct, into the blood veſſels, but muſt be ſubject to obſtructions, if we ſuppoſe there be no other paſſage for fluids into the ſyſtem.

5. The injecting of mercury, water, air, &c. from the blood veſſels into the lymphatics, in moſt parts of the body, demonſtrates that the lymphatics do not terminate in the thoracic duct. This has been done by moſt anatomiſts, and for which there is the greateſt authority that can be offered; but as it is a controverted point, which I wiſh particularly to conſider, I ſhall reſerve what I have to ſay on the ſubject, until I come to ſpeak of the lymphatic glands.

It will appear from the preceding obſervations—Firſt, that the objections and irreconcileable difficulties are ſo evident, as to demonſtrate that the thoracic duct cannot be conſidered as the termination of the lymphatic ſyſtem.

Secondly, that it is a univerſal law, that all the glands, whoſe uſes are known, are for the purpoſe of ſecreting fluids *from* and not *into* the blood: therefore, there can be no good reaſon aſſigned for aſſerting, that the lymphatic veſſels paſs through theſe glands to convey fluids into the blood, by means of the thoracic duct.

Thirdly, that poiſons abſorbed, which produce inflammation, and frequently ſuppuration in various parts of the body, do not produce ſuch effects on the thoracic duct; therefore, it is certainly fair to conclude, that if it were the paſſage by which theſe poiſons are to be conveyed into the blood, it would be liable to the ſame or ſimilar effects from poiſons as the other parts of the ſyſtem, which muſt deſtroy the perſon ſo affected.

Fourthly, that matter is carried from the head to the extremities, in a courſe diametrically oppoſite to the abſorbed fluids.

Fifthly, that the thoracic duct is too ſmall to be the termination of the lymphatic ſyſtem, becauſe we find in moſt parts of the body, ſmall branches of the lymphatic veſſels, many times larger than the thoracic duct itſelf, the ſuppoſed trunk of the ſyſtem.

Sixthly, that injecting the lymphatics from the blood veſſels in moſt parts of the body, and vice verſa, farther demonſtrates that the abſorbing ſyſtem cannot terminate in the thoracic duct.

It is not here admitted, that the lymphatic and lacteal veſſels are the ſame. When theſe veſſels were firſt diſcovered, they were judiciouſly conſidered as a ſyſtem of veſſels, differing from each other, and were diſtinguiſhed in this manner; that the lacteals aroſe from the inteſtines, and conveyed the chyle, a white fluid reſembling milk; whereas the lymphatic veſſels were found in moſt parts of the body; but as they conveyed a clear tranſparent fluid, and not a white one, they were called vaſa lymphatica, and by ſome, ductus aquoſi; but the modern anatomiſts from blending them together, under the common name of abſorbents, have thereby been the means of introducing errors, which would have in all probability been avoided, if they had been kept diſtinct and ſeparate, as they were by the anatomiſts who firſt diſcovered them; and our anatomy, I believe, would have been more correct than it is at preſent.

After the diſcovery of the lacteals, by Aſellius, an Italian anatomiſt, about the year 1622, on the meſentery of a living dog conveying chyle from the inteſtines, theſe veſſels were ſoon diſcovered in the human body as well as in moſt other animals; they were ſuppoſed to terminate in the liver, until Pecquet, in the year 1651, opened a living dog, from which he demonſtrated that the lacteals terminated in the thoracic duct, which he proved to enter into the ſubclavian vein, to convey the chyle to the heart and circulation; but after the diſcovery of the lacteals, by Aſellius, Mr. Cruikſhanks obſerves, p. 1, that "ſimilar "veſſels, however, were ſoon diſcovered "in other parts of the body, both in men "and quadrupeds; but as they contained "a watery and not a white fluid, they "were imagined to be different, and of "courſe obtained a different name: they "were termed generally, vaſa lymphatica." And in page 2, after advancing the arguments of the late Dr. Hunter, to prove the abſorbent ſyſtem to terminate in the thoracic duct, he adds, "thus a grand "ſyſtem for abſorption in men and quadrupeds was formed, and the lacteals and "lymphatics were blended together, under "the common name of abſorbents." And Mr. Cruikſhanks inforces this opinion, for he ſays in p. 119, part ii. "I have uſed "the terms *lacteals* and *lymphatics*, inſtead of "*abſorbents*, in order to avoid all ambiguity

" concerning the veſſels meant; but having
" there diſproved abſorption by red veins,
" I cannot now be miſapprehended; and
" ſhall, in future, employ the term *abſorbents* to ſignify *lacteals* and *lymphatics*,
" and ſhall write *glands of the abſorbents*,
" inſtead of *lymphatic glands*."

But before this doctrine can be admitted, the following arguments ſhould be firſt conſidered:

1. There are many lacteals which go to the thoracic duct, without entering any glands; this is admitted by many anatomiſts. Dr. Keill, in his anatomy, p. 39, ſays, that " there are many lacteals where " there are no glands." And Mr. Hewſon, p. 45, ſays, ſpeaking of the lymphatic veſſels of the abdomen, " that beſides the " veſſels which go into the glands, there " are generally ſome which eſcape them."

2. If the lymphatic and lacteals were the ſame, they ſhould abſorb the ſame fluid from the inteſtines; now this they certainly

do not; for in animals that are killed, after being fed, we frequently obſerve the lacteals carrying chyle from the inteſtines; and the lymphatics of the ſame part empty, or filled with a *clear, tranſparent fluid*, which is peculiar to *them*; the ſame as the *chyle* is to the *lacteals*. This has been obſerved by many writers. Now this being the fact, it is impoſſible to ſuppoſe that the lymphatics and lacteals, if they both ariſe from the inteſtines, were the ſame veſſels, and that they both performed the office of abſorption; that they ſhould be filled with different coloured fluids, if they abſorbed it from the ſame part of the inteſtines. It certainly would be fair, therefore, to infer, that the fluid in both ſyſtems of veſſels cannot be the ſame; and this being admitted, it muſt follow that the veſſels themſelves muſt be different.

One of the principal arguments advanced in favour of the lacteals and lymphatics performing the ſame office, is, that as the lacteals ariſe from the inteſtines, and convey chyle to the thoracic duct, the lymphatics do abſorb lymph from cavities alſo, which are ſuppoſed to terminate in the thoracic duct; and particularly as the veſſels themſelves are ſimilar. But this argument is far from being concluſive, becauſe we might, with equal propriety, argue and ſay, that as the arteries and veins reſemble each other, arteries muſt carry blood to the heart, as well as the veins, when the contrary is the fact; for we know that the arteries carry blood from the heart, and that the veins return it.

3. It frequently happens in ſcrophula, lues venerea, conſumptions, &c. that the greateſt part of the lymphatic glands in the abdomen are obſtructed, indurated, ſchirrous, and ſometimes are found to be in a ſtate of ſuppuration. Now, if the lacteals paſſed through theſe glands, in their way to the thoracic duct, as authors aſſert, it would appear evident, that the chyle would be prevented from paſſing through theſe indurated and diſeaſed glands. Mr. Cruikſhanks, p. 44, ſays, "where "the glands of the meſentery have been

" enlarged from ſcrophula, I have obſerved
" that the lacteals were then larger, and
" eaſier to be diſcovered or injected. This
" I conſider as the conſequence of obſtruc-
" tion in the glands, and of increaſed action
" in the veſſels, in order to overcome that
" obſtruction: though I do not remember
" an inſtance of ſuch obſtruction in the me-
" ſenteric glands, as made the chyle remain
" in the veſſels."

When the lymphatic glands are diſeaſed, the lymphatic veſſels are generally ſo likewiſe, and frequently deſtroyed: perhaps this may be one reaſon why the lacteals appeared eaſier to be diſcovered; it cannot be from increaſed action in the lacteals to overcome the obſtruction; as the lymphatic veſſels, only paſs from glands, and not the lacteals; for if they did, the chyle would certainly be obſtructed, when the glands through which they were to paſs were indurated. This is evidently the caſe in dropſies, where we find, on examining the bodies of thoſe perſons who have died of that diſorder, that the lymphatic glands are diſeaſed; and we alſo find the *lymphatic veſſels*, which are connected to thoſe glands, turgid, and ſometimes enormouſly diſtended with lymph or ſerum, ſometimes both mixed together; but it cannot be ſaid that the *lacteals* have ever been found turgid or ſo much enlarged as to be evidently the effect of diſeaſed glands.

Mr. Cruikſhanks ſays, p. 107, that "I have already given my opinion reſpecting Ruyſch's doctrine, that in old age he "lived without his lacteals, and that old "people in general did ſo. I think it impoſſible; but Morgagni and Dr. Hunter "himſelf inclined to that ſide, at leaſt ſo "far as reſpects the obliteration of the "glands of the meſentery. The lacteals "are never obliterated; there are no other "roads by which the chyle can get into the "blood, as Haller allows there may poſſibly "be, and the red veins of the inteſtines do "not abſorb." And again he ſays, that "it is "poſſible that children, and even grown perſons, may ſometimes have died of the tabes "meſenterica, a diſeaſe in which the glands

" of the meſentery, belonging to the lac-
" teals, are ſuppoſed to be totally obſtructed
" and impervious to the chyle. *In ſuch*
" *enlargements of the glands, if they ever*
" *take place*, we ſhould meet with the ſtagna-
" tion of the chyle in the firſt ſet of lacteals;
" but I never ſaw ſuch ſtagnation on any
" occaſion whatever. But as ſtagnation of
" the lymph, from obſtructed lymphatic
" glands of other parts, is ſaid to have
" been ſeen, it may be poſſible that the
" chyle, from the cauſes mentioned, may
" have ſometimes been prevented from
" getting into the blood veſſels."

Now, if the lacteals really did paſs through the meſenteric glands, in their way to the thoracic duct, the obſtruction or deſtruction of thoſe glands would be attended with the ſame effects to the lacteal veſſels, which is not the fact. It is well known that the chyle is conveyed into the blood after the meſenteric glands are obſtructed; and it is admitted that, in people advanced in life, the meſenteric glands are obliterated, yet the chyle is conveyed to the blood.

Haller aſſerts, that he has ſeen the thoracic duct full of chyle in perſons upwards of ſeventy years old, when the meſenteric glands are obliterated: and hence it muſt follow, that the lacteals cannot paſs through the meſenteric glands in their way to the thoracic duct.

Some authors ſuppoſe, that it is neceſſary that the lacteals ſhould paſs through the meſenteric glands; that the chyle may be ſtrained, and that the thinner or purer part only might be conveyed into the blood: but I apprehend this not to be the caſe; becauſe, if theſe glands did ſtrain the groſs parts of the chyle, as has been imagined, the crude part, which remains in the glands, muſt be continually liable to obſtruct them, which muſt be daily increaſed by the ſupply of freſh chyle to be ſtrained; I cannot therefore admit, that theſe glands can perform ſuch office, or that the chyle is changed or altered in the leaſt, after it paſſes from the inteſtines until it get into the blood.

Mr. Cruikſhanks, ſpeaking of the chyle, ſays, p. 95, that "this fluid is abſorbed

" from the cavity of the ſmall inteſtines, " by the radiated extremities of the lacteals; " is propelled through the lacteals by their " muſcular coat for ſome little way; after " which, it is again depoſited, by another " ſet of radiated extremities, into the cavi- " ties of glands, from whence it is again " abſorbed by the radiated extremities of " other lacteals, and thus alternately, till " having been ſtrained through a vaſt num- " ber of ſmall tubes and cells, it is at laſt " thrown into the thoracic duct, and by it " is propelled into and mixed with the " blood in the veins." And in p. 89, he ſays, " why the lymphatics and lacteals firſt " terminate in glands, I do not know."

Some authors ſuppoſe it neceſſary for the lacteals to paſs into theſe glands, for the purpoſe of mixing the lymph with the chyle to dilute it, but this is improbable; for in many inſtances the lymph is thicker than the chyle, which it, of courſe, could not render thinner; beſides, if the lymph really did dilute the chyle, there would be no neceſſity for its being ſecreted in parts ſo far diſtant from the lacteals, as is the caſe in many parts of the body.

From the preceding obſervations, I cannot admit that the lacteals do paſs into glands, becauſe, when the glands are *deſtroyed*, the lacteals, nevertheleſs, convey chyle; beſides, it does not appear of what uſe or benefit it could be, ſuppoſing it to be the caſe: but, on the contrary, if any thing groſs was to be ſtrained from the chyle, they would be liable to be obſtructed, and, of courſe, unfit to anſwer ſuch a purpoſe.

It appears, then, that the firſt diſcoverers of the lacteals and lymphatics were right in conſidering them as ſeparate and diſtinct ſyſtems; that there is no good reaſon for blending them together; that the *lymphatics* only come from *glands*, and *not* the *lacteals*; that the lymphatics are only connected with them in the ſame manner as the lymphatic ſyſtem is in all other parts of the body; as, for inſtance, their connection with the arteries, veins, nerves, &c. and is only a part of that general ſyſtem, diſperſed throughout the whole body, for the moſt important purpoſes: the *lacteals*, therefore, convey *chyle*—do *not* paſs into *glands*; and the *lymphatics* and *lymphatic glands* are only connected with them, as a part of that general ſyſtem diſperſed through the whole body, as will afterwards more evidently appear.

CHAPTER I.

OF THE LYMPHATIC GLANDS, AND DEMONSTRATION OF THEIR USES.

IT is not my intention, in theſe obſervations, to notice the various hypotheſes which have been given concerning this part of anatomy, any farther than may be neceſſary in this work, or to ſhew their connection and importance in the lymphatic ſyſtem.

Thus far is certain, that the ancients knew nothing either in reſpect to the component parts, or the uſes of the lymphatic glands, and only diſtinguiſhed them from other parts of the body, by repreſenting them as a particular kind of fleſh, without paying any attention to their internal ſtructure or uſe; but ſince the lymphatic ſyſtem of late years has been ſo much a ſubject of diſcuſſion, many ingenious phyſiologiſts have endeavoured to inveſtigate, and give to the world a definition of the component parts and uſes of the lymphatic glands; and although they have been, by their inquiries and experiments, enabled ſatisfactorily to explain what are the component parts of a lymphatic gland, yet they have not been ſo fortunate as to demonſtrate their uſe; which is by far the moſt material point, as the whole of our knowledge of the uſes of the lymphatic ſyſtem muſt ultimately depend on theſe glands.

Dr. Hunter in his Medical Commentaries, page 34, ſays, "I had made no "ſatisfactory obſervations upon the lym-"phatic glands for ſeveral years after I had "read lectures, and therefore never took "upon me to decide between Nuck and "Ruyſch, whether they were cellular or "only vaſcular. *All this, as well as the "manner in which the lacteals and lympha-"tics paſs through them, I profeſſedly gave "from authors, and not from my own obſer-"vations.* My brother found out, to the "beſt of my recollection, in the year 1753 "or 1754, that he could fill theſe glands

"uniformly, and the lymphatic veſſels
"going from them, by puſhing a pipe into
"their ſubſtance, as Dr. Nicholls had done
"in the *teſtis*. When examined in this
"way, they have exactly the appearance
"that Nuck deſcribes. After I had ſeen
"this experiment repeated to my ſatisfac-
"tion, I mentioned it in my lectures, and
"then confirmed what Nuck had ſaid from
"my own obſervation. Having found
"out ſo eaſy a method, my brother then
"intended *to have diſcovered or aſcertained*
"*the ſtructure, and, if poſſible, the uſe of*
"*the lymphatic glands*; *to have traced the*
"*lymphatic veſſels all over the body, and to*
"*have given a complete deſcription and*
"*figure of the whole abſorbing ſyſtem.*"

But as he has not publiſhed any experiments or diſcoveries, and there have been ſo many years elapſed ſince, it is reaſonable to infer that he left the ſubject as he found it, at leaſt as far as relates to the uſe of the lymphatic glands.

Profeſſor Monro in his anatomical Treatiſe on the Nerves, p. 3, ſays, that " the uſes for " which theſe oval bodies are ſaid to be de- " ſigned are, in my opinion, no more than " conjecture without any proof; and there- " fore I ſhall not attempt to explain their " office of acting, like ſo many hearts, in " aſſiſting to propel their fluids; nor to " ſhew the neceſſity of ſuch fluids being " collected in large quantities, at particu- " lar times, in theſe reſervoires, nor the " preparation they undergo there, for fitting " them to perform the offices aſſigned " them; but ſhall acknowledge my igno- " rance of the functions they perform."

Mr. Hewſon, p. 215, ſays, " who- " ever carefully views the lymphatic ſyſ- " tem, muſt be convinced, that as it explains " and points out the cure of many diſeaſes, " it deſerves the attention of the practiti- " oners of the healing art; and as it is ſo " generally diffuſed through the animal " kingdom, it ſtrongly claims the regard " of thoſe who wiſh to inquire philoſophi- " cally into the animal œconomy; eſpe-

“ cially, as by the knowledge of this ſyſ-
“ tem we are now flattered with the hopes
“ of aſcertaining the uſe of the lymphatic
“ glands, the thymus, and the ſpleen;
“ which diſcoveries are to be the ſubjects of
“ the third part of their inquiries.” This he did not live to finiſh, but they were publiſhed after his death by Magnus Falconer, and in them he endeavours to prove, that the ſpleen and lymphatic glands form the red globules of the blood; but this hypotheſis was conſidered inconcluſive, and, of courſe, given up.

Mr. Cruikſhanks very candidly acknowledges, p. 68, part 1ſt. that “ theſe bodies
“ are not only found on the meſentery, but
“ in a great many other parts of the body.
“ Their number is various in different bodies.
“ As the lymphatics and lacteals, of which
“ they form a part, were not known to the
“ ancients, one is not ſurprized to find them
“ aſſigning to theſe glands, the ridiculous
“ office of ſupporting, like ſo many
“ cuſhions, the larger blood veſſels *at thoſe*
“ *places where they were dividing into*

" *ſmaller branches.* And, indeed, though
" we know ſomething more of their nature
" and ſtructure, and diſeaſes, we know no
" more of their real uſe than the ancients."
And in p. 187, part 2d. " it will appear
" ſtrange that I have ſaid nothing of the uſe
" of the abſorbent glands. I avow abſolute
" ignorance of this matter. There are none
" in turtle, in fiſh, and only two in the
" necks of ſome birds; why there are ſo
" many in men and quadrupeds, I do not
" know, nor why they exiſt at all. I think
" this confeſſion much better than to at-
" tempt an idle hypotheſis, which would
" convince no body, and of which, I my-
" ſelf ſhould hereafter be aſhamed."

I cannot admit that any animals are deficient in the lymphatic glands; they are not ſo apparent or diſtinct in ſome animals, as in men and quadrupeds; but when this is the caſe, they have glandular coats or membranes, which are compoſed entirely of minute glands: thus, for inſtance, the palate, œſophagus, ſtomach, inteſtines, &c. of quadrupeds, fowls, and fiſhes, have glandular ſubſtances; and this is found to extend to moſt other parts. Therefore, although the lymphatic glands in ſome animals are not ſo diſtinct as in men and quadrupeds, yet they are equally numerous, and perhaps more ſo, only in different ſhapes; and we frequently ſee glands unite and run one into another, form glandular membranes; and we ſometimes find in the human body, glands united or joined together; when in others, the glands of the ſame part are found diſtinct and ſeparate. This is very different in various animals; the human brain is compoſed of a multitude of minute glands, united or joined together; but, on the contrary, in many birds and fiſh, the glands, which form their brain, are diſtinct and ſeparate; and the ſame is obſervable in many other parts of the body: therefore, whether the glands are diſtinct, or whether they run together, or are formed into membranes, it is very immaterial, as their offices will be performed either way; and this organization extends all through animated nature.

A lymphatic gland is compoſed of arteries convoluted: this is demonſtrated by injecting mercury, and other injections, from the blood veſſels into the lymphatic glands: and, on the contrary, the glands may be injected, by filling the lymphatic veſſels, when the mercury will paſs through the gland into the blood veſſels. There is no fact in anatomy better known than this, and it appears ſo plain and ſimple an operation, that one would imagine there could be no diſpute about the fact; yet it muſt be recollected, that if this experiment be admitted, it immediately overturns the doctrine of the lymphatic ſyſtem terminating in the thoracic duct, which there has been ſo much pains taken to eſtabliſh; becauſe it proves a direct communication from the lymphatics into the blood veſſels, from all parts of the body. Hence it will appear obvious, that to eſtabliſh the preſent ſyſtem of the lymphatics terminating in the thoracic duct, this experiment cannot be admitted: it was for this reaſon thought neceſſary to controvert and to deny, that the injections paſſed through *natural paſſages*, and to maintain that they were the effect of *rupture* or *laceration.* Now until the doctrine of the lymphatic ſyſtem terminating in the thoracic duct was propoſed, theſe experiments were never controverted; it could not be denied, that the injections paſſed from the blood veſſels into the lymphatics through the lymphatic glands; becauſe it was an experiment ſo well eſtabliſhed by the teſtimony of the moſt eminent anatomiſts, and even by thoſe who oppoſed it; therefore, the only evaſion they had, was to aſſert, that though the injections did paſs from the blood veſſels into the lymphatics and vice verſa, yet that they did not paſs through *natural paſſages*, but were the effect of *rupture, laceration, extravaſation*, or *diſeaſe.* The late Dr. Hunter taught this doctrine, with a view to ſupport what he advanced with reſpect to the lymphatic ſyſtem terminating in the thoracic duct.

Mr. Hewſon, a pupil of the late Dr. Hunter, in a note, p. 155, of the Lymphatic ſyſtem, wherein he refers to Dr. Hunter's Medical Commentaries, page 5, ſays, that “ Dr. Hunter and Dr. Monro found “ in their experiments, that injections rea- “ dily burſt from the arteries into the lym- “ phatic veſſels by the intervention of the “ cellular membrane; theſe experiments “ they at *firſt* conſidered (as Dr. Mekel “ does his) as proofs of their having filled “ the natural paſſages; but more careful “ obſervations ſeem to have *now* convinced “ the former of theſe gentlemen, that ſuch “ concluſions are fallacious, and he *now* “ thinks that the injection may have burſt “ into the ſides of the lymphatic veſſel.

The reaſon why Dr. Hunter ſhould have changed his opinion is ſufficiently obvious: it appears from what has been already obſerved, that Dr. Hunter and Dr. Monro had a controverſy, about which of them were intitled to the diſcovery of the lymphatic ſyſtem terminating in the thoracic duct.

Mr. Cruikſhanks, in mentioning this ſubject, obſerves, p. 3, that “ Dr. Hun-

" ter enjoyed the honour of this diſcovery
" for many years. At firſt, Profeſſor
" Monro was his only rival; the medical
" world were not always certain to which
" of theſe gentlemen the credit was due,
" but there were no doubts that one of the
" two was certainly intitled to it. Dr.
" Hunter, in his Medical Commentaries,
" ſupported his claim ſo well, that the
" greater part of thoſe who were intitled to
" hold any opinion on the ſubject, were on
" his ſide." Now, before Dr. Hunter and Profeſſor Monro claimed the honour of diſcovering the lymphatic ſyſtem to terminate in the thoracic duct, they did not diſpute the experiments which prove a direct communication from the blood veſſels into the lymphatics, but on the contrary admitted them; as ſoon, however, as they found it made againſt that ſyſtem they intended to introduce into the world, it then became neceſſary for them to change their opinions, as they could not admit an experiment that completely overturned the ſyſtem they were ſo anxious to introduce.

Mr. Cruikſhanks, p. 2, ſtates from the late Dr. Hunter, that " he farther obſerved, " that when injections thrown into the arteries and veins, from rupture of the veſſels, were *extravaſated*, they got into the " cellular membrane, and very commonly " from thence into the lymphatic veſſels; " or if a tube loaded with quickſilver was " puſhed at random into the cellular ſubſtance of a gland, the teſticle for example, the quickſilver would frequently paſs " into the abſorbents of that part."

Mr. Hewſon, page 169, ſays, " That " the lymphatics were only veins, anatomiſts were confirmed from experiments " made by injections; particularly the " *blowing air into the arteries of the kidney,* " *ſpleen, &c. and ſeeing it return by the* " *lymphatics*; a fact that has ſince been " proved to be owing to the air having " burſt from the arteries into the cellular " membrane, and ſo having got into theſe " veſſels, and therefore by no means " proving a direct communication between " thoſe arteries and the lymphatics." For this opinion he quotes the authority of Profeſſor Monro and Dr. Hunter; he then goes on to obſerve, that "other injections "likewiſe, ſuch as *mercury*, *water*, *&c.* "*having been thrown into the arteries, and* "*afterwards having got into the lymphatics,* "have been mentioned, as ſo many proofs "of a direct communication: but greater "experience with injections has convinced "ſome of the more accurate amongſt later "anatomiſts, of there likewiſe being a fal-"lacy in theſe experiments; or of the "fluids having got from the arteries into "the lymphatics not by paſſages, which "were natural to the living body, but by "ſuch as were the effect of *laceration in* "*the dead one.*"

Such are the arguments made uſe of to controvert an experiment that is ſo ſimple, that one would conceive it almoſt impoſſible there could be two opinions concerning it; particularly as it is ſo eaſy to demonſtrate a *direct* communication, not from *rupture*, *extravaſation*, or *diſeaſe*, but through *natural paſſages.*

If the injections had been really forced into the lymphatics from rupture or laceration, as theſe gentlemen think, it is certainly impoſſible, or at leaſt very improbable, that the laceration or rupture ſhould always be exactly in the ſame part, ſo as to let the injection from the blood veſſels into the lymphatics, which they all agree was the fact. Now, the effects from rupture or laceration are not found to be conſtantly the ſame, and therefore the injections would have paſſed in various directions, and of courſe could not be expected to go always from the *arteries into the lymphatics*: this, I think, is a circumſtance ſo ſtrong againſt the opinion of the injections paſſing into the lymphatics, in conſequence of rupture, extravaſation, &c. as in my opinion to admit the very thing, which they endeavour to controvert.

With reſpect to the aſſertion, that "greater experience with injections have "convinced ſome of the more accurate, "amongſt the later anatomiſts, of there "being a fallacy in their experiments," &

&c. I believe it may be fairly maintained, that many of the moſt accurate anatomiſts; men who have been deſervedly eſteemed, and of the moſt diſtinguiſhed abilities, who are intitled to every attention of the public; have aſſerted, that they have injected the lymphatics from the blood veſſels, where little or no force was uſed; and that there was not the leaſt appearance of *extravaſation*, *rupture*, or *diſeaſe*; and of courſe that their injections paſſed through natural paſſages and not through ruptured ones; and indeed Mr. Hewſon himſelf ſeems to be well-convinced of the importance of their authority; for he ſays, p. 137, "This is "a circumſtance" (meaning the injections paſſing from the blood veſſels into the lymphatics) "which has occurred in the experiments of the moſt eminent anatomiſts, "both in the paſt and of the preſent age; "ſo that there is no fact in anatomy in "favour of which more reſpectable authorities might be produced."

Dr. Hales in his Vegetable Statics, has related a variety of experiments, which ſatisfactorily prove a direct natural paſſage from the blood veſſels through the lymphatic glands into every part of the body; whilſt on the contrary, the arguments that have been advanced to controvert them, by alledging that they were the effect of *extravaſation*, or *laceration*, are by no means ſatisfactory; for moſt of his experiments were made by injections with a force no greater than that with which the blood circulates in the living body, and therefore it cannot reaſonably be ſuppoſed that ſuch force could be ſufficient to produce either rupture or laceration; neither is it in the leaſt probable, that the effects of theſe experiments were the conſequence of diſeaſe, becauſe many of them were made on living animals; and other experiments have clearly ſhewn that the moſt penetrating fluids, ſuch as ſpirits of wine, turpentine, quickſilver, and air, injected into portions of the arteries or veins with conſiderable force, will not paſs through their coats until they burſt; and hence it cannot be infered that the arteries or veins have inorganized pores, that admit fluids

fluids to tranſude through their coats, as the ſupporters of tranſudation aſſert.

Dr. Hales ſays, in his Vegetable Statics, vol. ii. p. 116, that he fixed tubes into the carotid artery, and cut both the jugular veins of ſeveral dogs, and injected warm water into the artery, with a force equal to that of the circulating blood; and he obſerves, that "If the warm water was con-
" tinued thus flowing into the artery for
" half an hour, or two hours, all the parts
" of the body would, during that time, be
" continually ſwelling bigger and bigger,
" ſo that there would be an univerſal
" dropſy over the whole body; both the
" aſcites and the anaſarca. The ſalivial and
" other glands were greatly ſwelled, and
" the mouth and noſe filled with mucoſe
" ſlimy matter, which flowed from thoſe
" glands; the *ubera* were much diſtended
" by the filling of their fat veſicles, as were
" alſo all the fatty veſicles of the body.
" All the muſcles were ſwelled and the in-
" terſtices of their fibres filled with water;
" and ſome of them were by this means
" waſhed

" waſhed white. *All this was effected with* " *a force of water no greater than that of* " *the arterial blood in its natural ſtate.*"

He then adds, " from whence 'tis pro-" bable that no veſſels were broken to " make way for this univerſal inundation; " but the penetrating water might readily " paſs through pores, and ſuch fine ſecre-" tory ducts, *as the more viſcid part of the* " *blood in its common courſe of circulation* " *never enters; but through which its more* " *attenuated and diluted parts do in their* " *proportion paſs.* Thus, for inſtance, we " ſee when the penetrating water flows " freely into the ſecretory ducts of the ſali-" vary glands, it makes the ſaliva flow " plentifully through the excretory ducts, " which, in a natural ſtate, being more gra-" dually ſeparated from the blood, flows " alſo more leiſurely through thoſe ducts."

I am clearly of opinion, that the water paſſing into the cellular membrane, &c. is not from tranſudation or forced paſſages; but that the water paſſed from the blood

veſſels,

veſſels, through the glandular viſcera, into the ſame paſſages as the different fluids would do, that are ſeparated from the blood, when the animal is living; and that the ſame effects would be produced in them, if it were poſſible to convey in the ſame time ſo much water as to diſtend and keep the blood veſſels filled; but this is impoſſible, for as ſoon as the blood veſſels, in living animals, are filled or diſtended to a certain degree with any fluid, the animal immediately dies.

Dr. Hales ſays, page 120, that "the "liver, from its own natural redneſs and "degree of firmneſs, turned gradually leſs "red, and ſometimes whitiſh, but always "ſwelled and was very hard; the water did "not flow through its veſſels into the vena "cava. The gall bladder was conſtantly "diſtended very full, ſo as to flow into the "guts. The pancreas was full of water, "as alſo the ſpleen, which was ſeldom "much diſtended, but was ſometimes "waſhed ſo clear of blood, as to be very "well injected with tinged liquors."

We are well convinced that theſe glands have natural paſſages, and excretory ducts to convey their fluids, which are ſeparated from the blood into the different parts of the body, and therefore cannot conſider the water running through them, and filling their excretory ducts, as the conſequence of laceration or tranſudation; becauſe we know that their natural fluids paſs through the ſame channels when the animal is living; then, why ſhould we aſſert, that fluids paſſing through the lymphatic glands from the blood veſſels, was the conſequence of rupture or extravaſation? It certainly would be fair, from analogy, to conſider fluids paſſing from the blood veſſels through the lymphatic glands, as through their *natural* but not *unnatural channels*, and that it was not the effect of laceration or extravaſation.

Dr. Hales ſays, p. 120, that he "ſlit "open four or ſix inches length of a gut, "juſt oppoſite to the inſertion of the me-"ſenteric veſſels into the gut; and having "then ſo folded open the gut, as to have

" the inward mucoſe coat outwards, I wiped " it dry," ſays he, " with a ſponge, which " was ſoon moiſtened in every part again, by " the water which oozed through from the " meſenteric arteries; and it was the ſame " on frequent repetition, and alſo when I " held this open part ſo as to make a ſmall " cavity or baſin with it, it would then " alſo be ſoon filled with water."

Theſe experiments were frequently repeated, and always with the ſame effects; that is, the water was always found to paſs readily from the blood veſſels through the meſenteric glands, and the glandular coats of the ſtomach and inteſtines, and even in ſuch quantities as to fill thoſe cavities with the injected fluid. He afterwards injected beer into the deſcending aorta, and found it went readily into the ſtomach and inteſtines: and in page 149, (after relating the method he took to inject an injection, compoſed of tallow, roſin, vermilion, and turpentine-varniſh, into the deſcending aorta,) he ſays, " I was in hopes by this means to have " fixed the coloured injected liquor, in the " im-

" immediate communications between the
" arteries and veins, but could not ſucceed
" ſo well as I expected to have done, not-
" withſtanding the injection paſſed from
" the arteries into the veins of the ſtomach,
" guts, and urine bladder, but eſpecially
" in the gall bladder; and carried with it
" ſometimes a little vermilion, and ſome-
" times none."

That the injection paſſed through the glands from the blood veſſels and ſo into the lymphatics, I think there cannot be a doubt. When the extreme parts of the arteries or veins are injected with coloured fluids, it is extremely difficult, if not totally impoſſible, to diſtinguiſh them from the lymphatics. Dr. Hales ſays, in theſe experiments, that he always found ſome of the injection in the cavity of the bowels, though the injections were made with no greater force than that of the arterial blood, which one would imagine could not be force ſufficient to rupture the veſſels, or to cauſe the injections to be extravaſated.

Where a branch of an artery convolutes, it forms a gland. In this part of the artery the vein terminates, as may be ſeen in many of the large glands, as in the ſpleen, pancreas, kidney, &c. This can be demonſtrated indiſputably, by injecting the artery in a part where it forms a gland; the injection will return by the veins, but not always, unleſs we paſs a ligature round the lymphatics which come out of the gland; for, if the gland is of a looſe texture, it will let the mercury through its ſubſtance into the lymphatic veſſels: at other times, if the gland is of a firm texture; we can inject the vein from the artery, without filling the lymphatics; but if we preſs the vein cloſe, ſo as to ſtop the mercury, and make a preſſure on the fluid in the artery, the eye will frequently follow the different convolutions, until it terminates in the lymphatics.

The meſenteric glands are, in general, of a looſe texture, as they let the injections paſs readily into the inteſtines; and in diarrhœas,

rhœas, the blood paſſes through theſe glands into the inteſtines, which does not ariſe from rupture or ulcer;* for on examining thoſe parts in perſons who have died of hæmorrhages, there has not appeared the leaſt veſtige of any diſorder: and I have known men, who have had monthly diſcharges of blood from the inteſtines, ſimilar to thoſe from the uterus of women: in both, I ſhould conſider, ariſing from the ſame organization of the lymphatics and blood veſſels.

Mr. Cruikſhank, page 50, obſerves, that "If lymphatics, it may be ſaid, ariſe from "arteries and veins, why do we not "oftener inject them from theſe veſſels in "the dead body? To this I reply, the "veins are certainly continued from the "arteries, and yet we count it a lucky in-"jection; if we fill the veins from the "arteries, unleſs the fluid injected is a very "ſubtile one, and ſuch as does not quickly "coagulate, oil of turpentine will often do

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* Dr. Huxham on Fevers, vol. ii. p. 5.

" it; but it tranſudes through the coats of " veſſels, and we can never be certain of " what has really taken place. Quick- " ſilver often returns by the veins, and as " it never tranſudes, we are more certain " what we have done, but the quickſilver " will not always return by the veins. " I have injected the arteries of the inteſ- " tines to the utmoſt with quickſilver, and " yet not a particle has returned by the " veins. I have reverſed this, and injected " the veins to the utmoſt, and yet not a " particle has returned by the arteries. " Are we, therefore, to infer, that the ar- " teries and veins are not connected, after " ſo many proofs that they certainly are?"

As the quickſilver is conſidered as a fluid that does not tranſude, and that when injected it neither returns by the arteries or veins, which is a fact I know to be the caſe very often; I ſhould apprehend that it went from the blood veſſels through the meſenteric glands into the inteſtines. Mr. Cruikſhanks does not mention whether he examined the inteſtine, but I am firmly perſuaded, that if he had, he would have found the quickſilver there, becauſe I have met with ſimilar inſtances.

Dr. Mekel has particularly diſtinguiſhed himſelf on this ſubject; having injected the glands and lymphatics from the blood veſſels in many parts of the body, he does not admit that his injections paſſed through unnatural paſſages, or in conſequence of rupture; but, on the contrary, aſſerts, there was not the leaſt appearance of *rupture* or *extravaſation.*

Now, to prove that there was rupture, it would appear to be neceſſary to uſe a degree of force to *cauſe* a rupture; and that the forcing the quickſilver might be ſufficient to produce it: admitting this to have its full force, there are methods of proving a direct paſſage or communication, where no force is applied, and even from changes which take place in the body, in health, as well as when diſeaſed; as for inſtance, the injecting of air, where little or no force is uſed, and ſeeing it go directly into the lymphatic veſſels.

Thus Mr. Cruikſhanks, although he denies this direct communication, yet obſerves, p. 50, " on the proceſs of the peri-
" toneum of the porpoiſe, through which
" the ſpermatic veſſels run, I inflated the
" abſorbents from the veins with the gen-
" tleſt breath I could blow: but here it may
" be objected, that in this animal there may
" be ſome uncommon connection between
" red veins and abſorbent veſſels. I can-
" not ſay that there may not be ſuch con-
" nection; but I ſtrongly ſuſpect there is
" not."

Certainly there is not. This organization is the ſame throughout the animal œconomy; the mere throwing coloured fluids, water, &c. with no force into the blood veſſels, will go into the lymphatics and cellular membrane; and in the *dead body*, we find that the blood paſſes through the ſame paſſages into the cellular membrane, through the lymphatic glands: theſe effects cannot be attributed to ariſe from *forced paſſages*, becauſe no force is uſed; therefore they prove a direct *natural paſſage* from the blood veſſels into the lymphatics, independent of all other experiments; and the arguments of forcing the injection through ruptured paſſages cannot be uſed here. But as theſe appearances equally overturn the doctrine of the lymphatic ſyſtem terminating in the thoracic duct, it was aſſerted, that they were the conſequence of *tranſudation*, and no proof of the fluids paſſing through natural paſſages; but that they tranſuded through *inorganized* parts. This doctrine of tranſudation is ſupported by the higheſt authority, and is at preſent received by the firſt phyſiologiſts. I am ſorry, however, to oppoſe ſuch authority, as I cannot admit that tranſudation takes place, either in the *living* or *dead body*; but that every thing we obſerve in it, is carried on by means of *organized* and not *inorganized* parts; it will be therefore neceſſary particularly to examine, what are the arguments advanced, in favour of the doctrine of tranſudation.

Mr. Hewſon, page 123, obſerves, from Dr. Hunter's Medical Commentaries, that the doctrine of tranſudation is ſupported as follows: "1ſt, The ready tranſudation "of watery and other injections after death. "2dly, The tranſudation of blood after "death, but not during life; for during "life, he" (Dr. Hunter) "ſuppoſes the "blood to be thickened by the coagulable "lymph; but when the lymph is jellied, "he concludes the blood is thereby made "thinner, and therefore more capable of "oozing through the inorganized inter"ſtices, by which it could not paſs before. "3dly, The tranſudation of bile, which "he thinks, takes place in the living body, "becauſe on opening a dead one we ſee all "the neighbourhood of the gall-bladder "tinged with this fluid."

Mr. Cruikſhanks aſſerts, that tranſudation takes place in the dead body; but denies that it does in the living; he ſays, page 10, "In dead bodies the fluids certainly tranſude: the veſſels in loſing life

“ loſe the property of confining their fluids.
“ Wherever the contained fluid is ſuffi-
“ ciently coloured, we can eaſily demon-
“ ſtrate this: bile, for example, is either
“ brown, yellow, or green, and blood of
“ a dark red: the firſt tranſudes through
“ the gall-bladder, and tinges the tranſverſe
“ arch of the colon, the duodenum, and
“ pylorus, in ſhort, all the neighbouring
“ parts, of the ſame colour with itſelf:
“ the ſecond alſo tranſudes through the
“ coats of veins, and makes the ſtomach,
“ for example, which is naturally white in
“ the living body, of a dark red. Thin fluids
“ injected into the blood veſſels, in the
“ dead body, alſo tranſude: glue diſſolved
“ in water, and thrown into the coronary
“ veins, tranſudes into the cavity of the
“ pericardium, and jellying, retains the
“ ſhape of that ſac; the ſame glue, injected
“ into the veins of the pia mater, tranſudes
“ into the ventricles of the brain, and when
“ cold and jellied, retains the figure of theſe
“ cavities: but nothing of this kind takes
“ place in the living body.”

Firſt then I anſwer, that watery and other fluids, paſſing from the blood veſſels into the various parts of the body, does not prove by any means that they paſſed through inorganized paſſages, and was the effect of tranſudation; but, on the contrary, I conceive that they paſſed through natural and organized parts. We might with as much propriety argue and ſay, that as a fluid is found frequently in the ventricles of the brain, and that we find bile and urine in the excretory ducts of the liver and kidneys; that they were the conſequence of *tranſudation*: but we cannot conſider them as ſo many proofs of thoſe fluids tranſuding through inorganized parts, particularly as we know that there are organs appointed to perform theſe offices. If we deſtroy the liver or kidneys, there will be no bile or urine; ſo it is throughout the body: if we deſtroy any organ, the effects of it will, of courſe, ceaſe. If fluids found in the various parts of the body, be admitted as a proof of their tranſuding, we may as well aſſert, that all fluids tranſude; for if tranſudation takes place in one part of the body, it would be fair to infer, that it is the ſame in all parts; as we cannot ſuppoſe that nature ever intended to perform the ſame office by different means, the great regularity and uniformity there is in the human body will not admit of ſuch an opinion, nor juſtify our aſſerting, that tranſudation, through inorganized paſſages, ever takes place; but, on the contrary, every thing we obſerve in it, ought to induce us to conſider it the effect of parts appointed to produce them.

Secondly, That the blood paſſing from the blood veſſels into the cellular membrane, &c. after death, is no proof of their tranſuding into thoſe parts; nor do I admit, that this is peculiar to the *dead body*; for the ſame or ſimilar appearances will happen to the *living*, if we apply the ſame cauſe which produced it in the dead; neither do I conceive that the lymph thickens the blood during life, ſo as to prevent its paſſing through thoſe paſſages which it does in the dead body, as Dr. Hunter imagined to be the caſe; nor can I admit, that when the lymph is coagulated, the blood is rendered thinner in the dead body, ſo as to let the blood into the cellular membrane, &c. through inorganized paſſages, which are ſuppoſed not to let the blood through in the living body, but *tranſude* in the dead one. The true cauſe of the blood paſſing into the cellular membrane, &c. in the dead body, is its being diſſolved from putrefaction, which takes place in three or four days, more or leſs, according as the ſtate of the atmoſphere is hot or cold, and the nature of the complaint of which the perſon died; and this is by no means peculiar to the dead body, as theſe gentlemen think; for in putrid fevers there is no part of the body, whilſt living, exempt from having the red blood diſcharged into it, according to the violence or malignity of the infection; thus, for inſtance, we frequently may obſerve in putrid fevers, blood diſcharged from the eyes, noſe,* ears, mouth, a diarrhœa, bloody urine, bloody diſcharge from bliſters, *petetchæ*, or livid ſpots all over the body; and when the fever becomes of ſuch a malignant nature, as to reſemble the plague, it becomes general throughout the body; and bloody ſweat is the conſequence. Now I do not admit theſe appearances to ariſe either from rupture or tranſudation, but from the red globules of the blood, diſſolved by putrefaction, ſo that they become as ſmall as the globules of lymph or ſerum, and, of courſe, paſs from the blood veſſels, through the lymphatic glands, into the lymphatic ſyſtem; which it could not do whilſt the body remained in health.

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* I know that a bleeding of the noſe will ſometimes happen from plethora, or from rupture of a ſmall veſſel; but that is quite a different diſcharge to that which is cauſed by putrefaction. Whenever theſe hæmor-

hæmorrhages happen, we may be aſſured, that it is cauſed from a diſſolution of the red globules of the blood, and is frequently attended with great danger; but as ſoon as we obſerve the ſaliva ſecreted on the tongue, or in the mouth, we may almoſt be aſſured of the patient's recovery, becauſe it ſhews that the ſeparations of lymph in the other parts of the body will be made, and the diſſolution of the blood prevented; for as long as the lymphatic ſyſtem is obſtructed, every hour is of the utmoſt conſequence until it be removed; there is no hopes of ſtopping the putrefaction of the blood until this is produced.

Thirdly, That the bile tinging the neighbouring parts in a dead body, is no proof of tranſudation, becauſe we may produce the ſame effects in the living one, by making uſe of the ſame cauſe that produced it in the dead, and in a much greater degree, ſo as to extend all over the body: but as I mean to ſpeak particularly on this ſubject, under the head of abſorption, I ſhould wiſh to reſerve what I have to offer, until I come to that part, when I ſhall endeavour to prove that this effect is not peculiar to the dead body, nor does it happen from tranſudation, which I do not admit ever to take place, either in the living or dead body.

It will therefore appear, from what has already been advanced, that the arguments uſed to deny a direct paſſage from the blood veſſels into the lymphatics, by alledging the means of rupture, laceration, diſeaſe, extravaſation, or tranſudation, do not by any means warrant ſuch an aſſertion or inference; nor can the arguments be conſidered either ſatisfactory or concluſive; and that there is a *direct natural paſſage* from the blood veſſels, through the lymphatic glands, cannot be fairly diſputed or denied; and ſuch paſſage is nothing more than a convolution of the artery, the lymphatics being a continuation of the ſame veſſel. But as this is a very critical point in phyſiology, and that it is of the utmoſt importance to have it clearly and indiſputably determined, as the moſt important conſiderations will ariſe from its being eſtabliſhed, I ſhall, therefore, only mention one more experiment of the many that might be produced, in favour of a direct communication from the blood veſſels into the lymphatics, which I think will ſatisfactorily and incontrovertibly demonſtrate this fact, ſuppoſing that nothing elſe could be offered in its favour, and particularly, as neither the argument of rupture, laceration, diſeaſe, or tranſudation, can be uſed to controvert it. It is this:—If, after feeding an animal, we kill it, and paſs immediately a ligature round the lymphatic veſſels which come from a lymphatic gland; the ſpleen, for example—we ſoon find the lymphatic veſſels filled with lymph, which comes through the gland from the blood veſſels:

that this is the fact cannot be diſputed, and if we cut into the ſubſtance of the gland, we find the ſame kind of fluid in it as in the lymphatic veſſels; which are convincing proofs of a direct paſſage from the blood veſſels into the lymphatics: and that the lymph in the lymphatic veſſels paſſed into them through this channel: we only know that fluids are ſeparated from the blood, becauſe we find them on the various ſurfaces, and in the cavities of excretory ducts, into which they had been ſeparated from the blood; as for inſtance: as the liver ſecretes bile, and the kidney, urine, ſo we find theſe fluids in their excretory ducts; hence we infer, that they were ſeparated from the blood by the glands into thoſe cavities. Now as it may be obſerved that the ſame fluid is found in the lymphatic glands, in the veſſels coming from thoſe glands, and on the different ſurfaces, and in the cavities of the body, it is certainly fair to infer, that the lymphatic veſſels are the excretory ducts of the lymphatic glands: the proofs are exactly the ſame, and equally concluſive: therefore, THE USE OF THE LYMPHATIC GLANDS

IS FOR THE SEPARATION OF THE LYMPH FROM THE BLOOD.

From what has been advanced in the preceding obſervations and experiments, it is therefore evident,

1. Not only that the lymphatic ſyſtem does not terminate in the thoracic duct, as is the prevailing opinion, but alſo,

2. That the lymphatics and lacteals are diſtinct and ſeparate ſyſtems of veſſels.

3. That tranſudation does not take place either in the living or dead body; but that every thing we obſerve in it, is the effect of organization,

4. That the lymphatic veſſels are excretory ducts to the lymphatic glands.

5. That there is a *direct natural paſſage* from the blood veſſels through the lymphatic glands into every part of the body.

CHAP. II.

THE INTRODUCTION AND DEMONSTRATION OF THE NEW LYMPHATIC SYSTEM.

IT has been uſual for anatomiſts to take the origin of the Lymphatic ſyſtem from the different cavities and ſurfaces of the body: but I ſhall take mine from the heart, as its proper origin.

This ſyſtem is extremely ſimple, it ariſes merely from an extenſion of the arteries: to illuſtrate what I mean, ſuppoſe, for example, we take the branch of an artery; (and I wiſh it to be underſtood, to apply to the whole of the arterial ſyſtem.) A branch of the aorta, for inſtance; we cannot trace this artery to its termination. Dr. Keill, in his Anatomy, p. 310, ſays, that "As the "arteries grow ſmaller and ſmaller, ſo theſe "coats grow thinner, and the coats of "the veins ſeem to be only a continua-"tion of the coats of the capillary arte-"ries."

" ries." And Mr. Cruikſhanks, p. 59, ſays, ſpeaking of the coats of the blood veſſels, that " Theſe coats become thinner " the farther we go from the trunks, till " at laſt it is no longer poſſible to ſeparate " them in the branches; and their ex" iſtence is only inferred from analogy." This being admitted, we can trace the artery until it becomes extremely ſmall in many parts of the body, and its coats are thin in proportion, ſo that they frequently appear tranſparent when they are filled with red blood. Now, let us ſet out from the aorta again, and we may obſerve, that in tracing this artery, it gives out, in its paſſage, various anaſtomoſing branches, from which we can trace them, running into and forming convolutions, or what we commonly call *lymphatic glands:* and this ſyſtem is obſerved in great abundance throughout the body. Hence ariſes the impoſſibility of tracing them, as *arteries*, to their terminations; becauſe, after they have formed convolutions or *glands*, they do not convey red blood, as it cannot be admitted *through* the *glands*, whilſt the body is in health: but after theſe glands are ſo formed by the artery, *the artery then divides anaſtomoſes, and the ſame veſſel immediately become a ſyſtem of lymphatic veſſels*; which, as they extend, become ſo extremely minute, as not to be poſſibly diſtinguiſhed by the naked eye; and in this *ſtate they unite*, and form the different parts of the body; ſuch for inſtance as the perioſteum, pleura, mediaſtinum, peritonæum, adipoſe membrane, cutis, &c. as well as ſeveral other parts of the body, which do not contain red blood, which is only confined in the arteries by the globules of blood being ſo large, as not, *in health*, to paſs through theſe paſſages, which are formed for the lymph.

Now, I am induced to believe that all theſe parts of the body, juſt mentioned, are formed from the extenſion of the lymphatic veſſels, from the following conſiderations: 1ſt. That although it appears to the naked eye that membranes, the ſkin, for inſtance, appear to be a crude or undigeſted maſs; yet if we examine it with a microſcope, it appears a beautiful and regular ſyſtem of veſſels;

ſels; and the ſame appears from the examination of any other minute part of the body with a microſcope. 2d. In many diſorders we can evidently ſee, with the naked eye, that membranes are compoſed of veſſels, ſuch, for inſtance, as the tunica conjunctiva, or what is commonly called the white of the eye: for when we examine this membrane, when it is in a ſtate of inflammation, *millions of veſſels* appear to the naked eye filled with red blood, which has been forced into the lymphatic veſſels, ſo as to make a very beautiful appearance, and do evidently demonſtrate, that it is wholly compoſed of *minute veſſels*. This may be equally obſerved in *all* other *membranous parts* that are in a ſtate of *inflammation*, where the *globules* of the *blood* are *broken* and forced into the *lymphatic veſſels*, which conſtitute theſe parts, which are all formed from the ſame ſyſtem; ſo that theſe membranes are, conſequently, organized parts, and may be conſidered as the *termination of the lymphatic ſyſtem.*— 3d. When an inflammation happens to the pleura, mediaſtinum, cellular membrane, peritonæum, &c. if it does not terminate by reſolution, but ſuppuration takes place, the conſequence is, that the parts that are ſeparated from the ſound parts will leave the lymphatic veſſels ſo much changed or altered from their original formation, as to cauſe an extravaſation of their fluid, as we may obſerve in the pleuriſy, peritoneal inflammation, puerperal fever, &c. the cauſe of theſe effects is evidently from the inflammation and ſuppuration of the lymphatic veſſels which conſtitute and form theſe membranes, which muſt leave the veſſels open, from which the diſeaſed parts had been ſeparated, and, conſequently, an extravaſation of lymph will follow, as is the caſe in theſe complaints. 4th. When any of the membranous parts are injured by the ſmall pox, a wound, burn, or any other means, the ſkin which covers the parts that have been injured, is very different from that which exiſted before the accident, as appears by comparing the ſcars or marks, with the ſkin of the other parts of the body; there are no pores in it, and, of courſe, no perſpiration can paſs through its ſubſtance; and if it was a part where there was formerly hair, it will not grow again, as the lymphatic veſſels, which formerly terminated and formed it, are deſtroyed: and although the lymphatic ſyſtem extend to, and cover over a *wounded* part, yet it continues ever afterwards in a very different ſtate from its original formation.

If there were any ſyſtem of veſſels which originated from the ſurfaces or cavities, as the lymphatic veſſels were *ſuppoſed* to do, and that they were extremely numerous; if this, I ſay, were really the caſe, it would follow, that no diſorder that the body could be ſubject to, would colour the whole of the ſkin in the manner we frequently ſee it; becauſe, if any ſyſtem of veſſels did exiſt, independent of the lymphatics, they would take up ſome ſpace, and could not tinge or colour the ſkin in thoſe parts where ſuch veſſels are ſuppoſed to originate; as we frequently obſerve in the ſmall pox, eruptions, jaundice, bloody ſweat, that no part of the body can be perceived, even ſo ſmall as a pin's point, but what is tinged with the bile or blood; and we can produce the ſame effects by feeding animals on fluids impregnated with various colours; ſo that even the very ſubſtance of the bones ſhall be deeply tinged. Theſe are facts which prove how very generally the lymphatic ſyſtem extends, even to the moſt minute parts; and that there is no part of the body but what receives the lymph by means of this ſyſtem.

If we conſider the component parts of the blood, we ſhall find it to be a compound fluid, whoſe globules are made of different ſizes, ſo as to adapt them to paſs through ſome paſſages, and be retained in others. The globules of lymph, ſerum, urine, milk, &c. are conſiderably ſmaller than the red globules of blood: this is confirmed by numberleſs microſcopical experiments of the beſt authors, and indeed it does not appear more ſurprizing, that there ſhould be ſo great a difference in the globules, than in the denſity of fluids; as, for inſtance, mercury is denſer than water, water than air, air than light, &c. And hence, the great conſequence of the *lymphatic*

phatic glands, as being the very organs by which the lymph paſſes to the reſpective parts, as it is the only paſſage from the blood veſſels into the lymphatic ſyſtem.

The globules of the blood, like all other animal ſubſtances, are deſtroyed by putrefaction, as may be ſeen by mixing ſome freſh globules of blood with putrid ſerum; they will, as ſoon as they begin to diſſolve, have the appearance of a mulberry; and, if ſuffered to remain, they break and become entirely diſſolved. All putrid and fermented fluids have no globules when fermentation or putrefaction takes place; the blood, lymph, urine, &c. are then blended together, and run into every part of the body, and therefore blood can only anſwer the purpoſes of our exiſtence, ſo long as the fluids, of which it is compoſed, retain their globules.

There is a great analogy between the lymphatic ſyſtem of animals, and the bark and leaves of trees, plants, fruits, &c. which ſeem to derive life from ſimilar means to that of animals: I ſhould conſider their barks, in fact, to be their lymphatic ſyſtem, and of the ſame importance to them as the lymphatic ſyſtem is to the animal œconomy: for, if we cut the bark of a tree, we cut off the connection, or means, by which fluids are conveyed to it for its nutrition; and although you give it as much water as you pleaſe, after the bark has been cut, the tree dies. Now, if we deſtroy the lymphatic glands, we cut off the means by which the lymph is to be conveyed to the body, and the animal will certainly die, although there may be no defect in the blood veſſels, nor the blood deficient either in quantity or quality: for inſtance, ſuppoſe a perſon afflicted with a white ſwelling in the knee, a diſorder which is produced by an obſtruction of the lymphatic glands; we may obſerve the limb waſte and daily diminiſh, until it becomes entirely deſtroyed; this does not ariſe from any obſtruction in the blood veſſels, becauſe, if we feel the pulſation of the artery in the deceaſed and emaciated limb, and compare it with the pulſe in the wriſt, we ſhall find they beat alike. When the lymphatic glands become entirely obſtructed, a mortification is the conſequence, becauſe the channel, by which the fluid is to be conveyed, is cut off in a ſimilar manner to the bark of trees when cut; the fluid cannot be conveyed, and the parts deprived of it, die.

Conſumptions are cauſed by a diſeaſe of the lymphatic glands, for we find them in a ſtate of obſtruction or ſuppuration, in perſons who have died of this complaint. We may obſerve in theſe perſons, that when the diſorder firſt appears, the body waſtes gradually; it goes on in this manner for ſome time, waſting more and more, ſo that it may very properly be ſaid to be dying by inches; for, in proportion as the glands become more obſtructed, or diſeaſed, ſo does the diſorder increaſe, and the body diminiſh; and, at laſt, when no more lymph can be admitted, the miſerable patient frequently dies in a few hours. The blood of perſons who have had conſumptions, when in an advanced ſtate, is always found to have a ſtrong ſize; this is produced by the lymphatic glands being obſtructed, ſo that the lymph is confined in the blood veſſels, which become violently diſtended, and cauſe ſuch an oppreſſion in the lungs, as to threaten ſuffocation, which can only be relieved by bleeding; I have frequently known this to be neceſſary three or four times a day, to keep the patient from being choaked, although this could only be conſidered as a temporary relief, by leſſening the quantity of blood in the veſſels, which was not at all altered by the bleeding; but it was always accompanied with a ſtrong ſize and buff, the ſame as if no blood had been taken away.

The lues venerea, ſcrophula, ſpina ventoſa, &c. in their advanced ſtate, ariſe from a diſeaſe or obſtruction of the lymphatic glands, in a ſimilar manner to conſumptions; they both are attended with a deſtruction of the lymphatic ſyſtem. It is not, I believe, in the nature of things, or in the power of human invention, to cure theſe diſorders when advanced, unleſs we poſſeſſed the power of replacing theſe organized parts, which are ſo eſſential to our exiſtence; yet by an early application to diet, and a few medicines, theſe diſorders may very frequently be cured; and when more advanced, may be greatly relieved.

From the lymphatic glands being hurt or injured, in animals that are young and growing, as in caſes when they have their limbs of different ſizes, we frequently ſee lame perſons who have a leg, an arm, or other part, ſmaller, or out of proportion to the reſt. This originally happens from ſome of the principal glands being injured or deſtroyed, by a blow, or otherwiſe; the conſequence whereof is, that the limb which has all the glands, and is ſupplied with more lymph, will arrive at its full ſize or growth, whilſt the other will be diminiſhed, in proportion to the number of glands injured, and conſequent privation of lymph: and hence ariſe the various defects or deformities we frequently meet with. I have ſeen a very remarkable inſtance of this ſort in a young growing dog; the glands of the neck became very much ſwelled and indurated;

durated; the joints of the fore legs became alſo much enlarged, ſimilar to what we ſee joints in ſcrophula: they made a cracking noiſe when the animal endeavoured to walk, and all the fore part of the dog waſted, and became conſiderably leſs than the hind parts, which grew proportionably much larger, and had the appearance of health. This was evidently the effect of more lymph being conveyed through glands in thoſe parts that were unobſtructed, and cauſed the increaſe; as on the contrary, the other parts were diminiſhed, from the lymph being denied a paſſage through the diſeaſed glands, which readily accounts for the increaſe or decreaſe of thoſe particular parts.

It is a common practice for perſons to ſtop the growth of puppies, by bathing them with ſpirits, which deſtroys ſome of the glands, and prevents the lymph increaſing the ſize of the animal. It is obſervable, that perſons who drink ſtrong ſpirits, almoſt always die conſumptive or dropſical, from the lymphatic glands being obſtructed or deſtroyed.

Hence farther appears the great importance and uſe of theſe glands.

There alſo ſeems to be a great analogy between the lymphatic glands and the roots of trees; if, for inſtance, we cut off half the root of a tree, it will diminiſh until it come to ſuch a ſize as the root can ſupply with fluid ſufficient for its nouriſhment; but, on the contrary, if we cut off half the tree, and leave the whole of the root, the root will throw out new ſhoots; or increaſe the old ones to ſuch a ſize as to receive all the fluid which the root can ſupply; and therefore the root always correſponds with the ſize of the tree.

It is nearly the ſame with the lymphatic glands as with the roots of trees: if we deſtroy part of them, the parts of the body which are deprived of their lymph will waſte, until they come to ſuch a ſize as the remaining glands can ſupply with lymph: if the glands are numerous, and ſecrete more lymph, than is neceſſary for the waſte that is conſtantly going off, the body increaſes in proportion to the quantity of lymph that is ſuperfluous. *This is very remarkable in all young and growing animals, and the reverſe in old age.*

From the time of birth, the body increaſes conſiderably more in proportion than at any other period ever after. This is performed by the lymphatic ſyſtem: the arteries are much larger—more numerous for the purpoſe of extenſion, and increaſing the different parts; the vibrations of the heart are much quicker to force the fluids to the extremities of the lymphatic ſyſtem; the lymphatic glands all over the body are larger in proportion, and more numerous than at any other period. When the body arrives at its proper growth, it remains a certain time in that ſtate; it neither diminiſhes nor increaſes, as the whole of the lymph ſecreted is then no more than ſufficient to repair the loſs that is continually made; but as ſoon as the arterial ſyſtem loſes the power of forcing the lymph to the extremities, it then begins to waſte. The heart, in old age, does not vibrate near ſo often, and becomes

comes weak and unable to force the lymph through the lymphatic glands to the extremities of the ſyſtem; inſtead of the arteries being larger in proportion to the veins, as is the caſe at birth, the very contrary takes place; and they become ſmall and waſte; the veins, on the contrary, are large, dilated and varicoſe, loſe their power of reſiſting the force of the heart and arteries, and the blood paſſes into the veins that are thus dilated, ſo that little or no lymph is preſſed through the glands. In ſhort, the whole of the lymphatic ſyſtem is, in old age, the reverſe of what it was at the time of birth; and when old age advances, the lymphatic glands become obliterated in many parts of the body, ſo as to cauſe the lymphatic ſyſtem to ceaſe; a total or *partial* mortification takes place, and converts bones, fleſh, membranes, &c. into its original matter; and therefore life ceaſes in all parts, when the lymphatic ſyſtem ceaſes to perform its functions.

CHAP. III.

OF ABSORPTION.

IT is a fact, well-known from the moſt early ages, that there is a power in an animal body of abſorbing fluids; and modern obſervations have ſhewn, that this power of abſorption even extends to ſolids; as for inſtance, quickſilver rubbed on the ſkin, in form of ointment, gets into the circulation; and calomel rubbed on any part of the body will produce a ſalivation. Now the great diſpute is, by what means this power of abſorption is performed. There have been two opinions. The ancients aſſerted, that abſorption is performed by the red veins, and that their orifices open on ſurfaces and cavities of the body, to abſorb. This doctrine was generally admitted by all old writers, and has been warmly ſupported by ſome of the moſt celebrated modern authors, who have added many arguments and experiments to thoſe of the ancients, to prove their doctrine true, and that abſorption is performed by the red veins, as they aſſerted. The principal experiments which have been brought in favour of this doctrine, are,

1ſt. That Swammerdam made a ligature on the meſenteric veins, which ſtopped the circulation of the blood in thoſe parts; and found it ſtreaked with white chyle, which he ſuppoſed was abſorbed from the inteſtines by the meſenteric veins.

2dly. Lieberkuhn aſſerts, that he ſaw the injection run from the orifices of the meſenteric veins into the inteſtines.

3dly. Dr. Hales injected a coarſe injection into the blood veſſels, with a force equal to that with which the blood circulates in a living body; and he found part of the injection in the inteſtines.

4thly. The celebrated Kauw Boerhaave's experiment has been frequently quoted as great authority. He injected water into the ſtomach and inteſtines of a dog, which being compreſſed, he ſaw the water run into the meſenteric veins in ſuch a quantity as to waſh out the red blood, ſo that the veins appeared white.

5thly. Dr. Mekel filled red veins, by injecting the cavities of the veſiculæ ſeminales, bladder, &c.; and, on the contrary, he injected theſe ſurfaces or cavities from the blood veſſels; and the ſame in ſeveral other parts of the body.

Such have been the principal experiments brought in favour of the red veins being abſorbents, which have been conſidered by many very eminent phyſiologiſts to be perfectly ſatisfactory and concluſive. Even Baron Haller, in many parts of his phyſiology, ſupports this doctrine of abſorption by the veins: yet it is far from being generally received; for many equally eminent anatomiſts have been of a different opinion, and have denied that the red veins abſorb; but aſſert that the lymphatic veſſels perform this important office. They have endeavoured to controvert the arguments and experiments on which the doctrine of the red veins abſorbing is eſtabliſhed; and have adduced others, in ſupport of the lymphatics being a ſyſtem of abſorbents, and not the veins. Theſe are,

1ſt. That injections from the lymphatics into the blood veſſels, and from the blood veſſels into the lymphatics, did not go through natural paſſages, but were the effect of rupture, laceration, extravaſation, tranſudation, or diſeaſe, which of courſe could not be depended upon as proofs of their paſſing into the veins through natural paſſages.

2dly. That the abſorption of poiſons, ſuch as the venereal, variolous, &c. inflame the lymphatic veſſels, which may be evidently ſeen, as they appear then like ſo many red lines, when the veins are not affected; nor have they any appearance of inflammation.

3dly. That the lymphatic veſſels may be ſeen, as they are then inflamed, to convey the poiſon they abſorb into the neighbouring glands, and that they ſometimes inflame and ſuppurate, as in the venereal buboe; and we frequently obſerve the lymphatic veſſels and glands inflamed or ſwelled, by the abſorption of matter, from an abſceſs, ulcer, iſſue, or bliſter; in all of theſe inſtances the lymphatic veſſels and glands are affected, and not the veins; and that it would be fair to infer, that if the red veins abſorbed, they would be ſubject to ſwell and inflame, in the ſame manner as the lymphatic veſſels*.

4thly. The lacteals are admitted to abſorb chyle from the ſurface of the inteſtines, and to terminate in the thoracic duct; the lymphatics, as they are ſimilar, and reſemble the lacteals in their valves and in moſt other reſpects, therefore they are alſo conſidered the abſorbents of every other ſurface or cavity of the body, and the only difference between them is in their name.

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* As the veins do not inflame or ſuppurate from the abſorption of poiſons, it is certainly a concluſive argument, that they do not abſorb, and this on the ſame principle, that the thoracic duct does not inflame or ſuppurate; for when the lymphatics and glands inflame and ſuppurate, it is equally concluſive, that the thoracic duct is not the termination of the abſorbent ſyſtem.

Such have been the principal arguments advanced to controvert the doctrine of the red veins abſorbing.

That the lymphatic veſſels do abſorb, and not the veins, I have not the leaſt doubt; for, before it can be eſtabliſhed that the red veins do abſorb, we muſt overturn the circulation of the blood, which is a doctrine now ſo univerſally received, as not to admit of a doubt, and what profeſſional men in all countries throughout Europe have eſtabliſhed.

This is a circumſtance, that I am ſurpriſed the oppoſers of venal abſorption did not avail themſelves of, as it would indiſputably have overturned the opinion of the red veins abſorbing, ſo long as the circulation of the blood is received. Now the principle, upon which the circulation is eſtabliſhed, is, that the vein terminates in the artery; and although this cannot be demonſtrated in the moſt minute parts of the body, yet in many of the larger branches of the blood veſſels, we can prove this anaſtomoſing of the artery and vein by injections; therefore it is fair to infer, from analogy, that the artery and vein anaſtomoſes throughout the body; and that this is the fact is certainly indiſputable, becauſe the circulation of the blood is eſtabliſhed upon this very principle: beſides, in ſome animals, and particularly in fiſh that are tranſparent, we can, by the aſſiſtance of the microſcope, abſolutely ſee the circulation of the blood in the artery returned by the vein; and this being admitted, it will follow, that *veins cannot terminate in ſurfaces or cavities with open mouths*, as the ſupporters of venal abſorption have aſſerted, *but muſt terminate in the artery*; and hence it follows, *that the veins cannot abſorb.*

The experiments that are advanced in favour of the red veins abſorbing are, in themſelves, unqueſtionably unanſwerable; becauſe they have been ſo often repeated by men of the firſt eminence, and admit of being ſo eaſily demonſtrated. Whenever this is the caſe, there can be no doubt, nor can the fact be overturned. But theſe experiments can *by no means juſtify ſuch a concluſion.* If we admit them to the fulleſt extent, they prove no more than what I have proved before; namely, *that there is a direct natural paſſage between the blood veſſels and lymphatics*, and ſo far from proving the veins a ſyſtem of abſorbents, I ſhall on the contrary proceed to ſhew, *that theſe very experiments* will make it appear evident that the *lymphatics* are a ſyſtem of *abſorbents*, and *not the veins.*

The extenſion of the arterial ſyſtem forming as I have repreſented, in the preceding obſervations, the membranes of all ſurfaces and cavities of the body whatever, opens a direct paſſage *to* and *from* the circulation,

culation, through the *lymphatic glands and veſſels*, by which means fluids are carried to all parts of the body *from* the blood; and all *abſorbed fluids* by the ſame ſyſtem are conveyed *into the blood*, and this immediately explains how injections, &c. applied to ſuch ſurfaces, under particular circumſtances, may be conveyed into the blood veſſels, *to* and *from* every part of the body: there is not, therefore, the leaſt reaſon to doubt the accuracy of the experiments brought in favour of venal abſorption, as they *only prove this paſſage into the blood veſſels*, and by no means prove the veins a ſyſtem of abſorbents, on the contrary; I ſhall now proceed to ſhew that they demonſtrate the *lymphatics* to be a ſyſtem of abſorbents.

It appears, from what has already been advanced, that the lymphatic ſyſtem is compoſed of veſſels, *conveying the lymph through the lymphatic glands*, from the blood veſſels to all parts of the body, for the important purpoſe of repairing the loſs that is continually made; *but that is only* *one part of their office*; for when this ſyſtem has performed its office of conveying the lymph, and the loſt parts are repaired, which is done by repletion; they afterwards become *mere empty tubes*, and when in ſuch a ſtate, they then become a *ſyſtem of abſorbents*: for it cannot be ſuppoſed, that fluids conveyed *from* the blood, and thoſe that are carried *into* the blood, by abſorption, diametrically oppoſite to each other, can be conveyed in contrary directions in the ſame veſſel, and at the ſame time: but after they have conveyed the lymph to the various parts of the body, they then, from being empty tubes, become a proper ſyſtem of abſorbents, and will abſorb whatever is applied to the ſurface of any part of the body; and according to the degree of *inanition* or *repletion* of the lymphatic veſſels, ſo will the body be *more* or *leſs* ſuſceptible of abſorption of any fluid applied to the ſkin, or any other ſurface or cavity of the body: for I ſuppoſe the membranes of the internal parts, ſuch as the pleura, peritoneum, cellular membrane, &c.

to poſſeſs the ſame power of abſorption as the cutis.

Abſorption in plants appears perfectly analogous to the power of abſorption in animals, which is increaſed or diminiſhed in both, by the *increaſe* or *decreaſe* of fluids in their veſſels. Dr. Hales has clearly demonſtrated the ſurprizing variation in the quantity of moiſture imbibed and perſpired by different plants, under different ſtates of the atmoſphere, and alſo has ſhewn that they will *not abſorb* at certain times. I have ſeen the rain abſorbed from the leaves of plants as faſt as it fell on them, for ſome time; but as ſoon as the veſſels are filled, the leaves no longer abſorb, the water then runs off as faſt as it fell on them; whence it is evident, that plants will abſorb, from fluids applied either to the roots or leaves, as long as the *abſorbent veſſels are empty.* It is the ſame with animals; if we fill the blood veſſels with fluids, it will perſpire from all the different ſurfaces or membranes of the body, in like manner as from the barks and leaves of plants; and alſo in a ſimilar manner, when the fluids of the animal are exhauſted, it will abſorb from every ſurface or cavity whatever; as on the contrary, when the abſorbent veſſels are filled, *it will no longer abſorb.*

The lymphatic veſſels are frequently found empty; it is uſual for anatomiſts to feed the animals, on whom they intend to demonſtrate the lymphatic veſſels, previous to their being killed, and then they are found turgid with lymph; but if this is neglected, and the animal has faſted for ſome time, they are ſometimes inviſible, or diſcovered with great difficulty. Yet it frequently happens, that in dying animals the contraction of the arteries is ſo great, as to ſeparate the lymph from the blood which paſſes into the lymphatics; hence this has given riſe to the aſſertion of many celebrated anatomiſts, that the lacteals have been filled with a tranſparent fluid, inſtead of chyle, which they imagined was abſorbed from the inteſtines: but nothing can be more erroneous than this opinion; for it is very evident, that it is preſſed through the lymphatic glands into the lymphatic veſſels, by the contraction of the heart and arteries, and is not abſorbed from the inteſtines by the lacteals, as they imagine.

If it be admitted that the lymphatics have this power of abſorption, *only* when they are *empty*, many very important circumſtances will ariſe, as it *opens quite a new field*, *explaining* many things, which, according to the preſent ſyſtem of things, appear *inexplicable*; and in which the *treatment* of every *diſeaſe* that the body can be ſubject to, is ſo materially concerned.

This ſyſtem enables us, either by *repletion* or *inanition*, to *fill* or *empty* the lymphatics whenever we pleaſe; and gives us the power of preventing all *infection* by *contact*; and, on the contrary, we have it in our power to put the body in ſuch a ſtate, as to be ſuſceptible of abſorbing whatever we wiſh, or may be conſidered neceſſary to be carried from the *ſkin*, or any other *ſurface* of the *body*, into the *circulation*.

That the body has the power of abſorbing at *one time*, and *not at another*, is a fact well known, and repeatedly obſerved by profeſſional men; and it is a circumſtance that has always been conſidered as inexplicable: but the admiſſion of this ſyſtem will immediately explain theſe difficulties.

It ſometimes happens, that two men will be connected with the ſame woman, who has a venereal diſorder; and one man eſcapes receiving any infection, whilſt the other will have all the ſymptoms of the moſt malignant gonorrhœa. This, in the courſe of my practice, I have often ſeen; and I believe it is a circumſtance that has occurred to many other profeſſional men; yet it has been conſidered as a phænomenon that cannot be accounted for. I have heard an attempt to explain it in the following manner, viz. "That the firſt man connected "with the woman would abſorb the whole "of the infectious matter, and that, of "courſe, the ſecond man could not be ſub"ject to receive the infection." Now this would be deſerving of ſome credit, if it were true, that the firſt man always received the diſorder; but this is by no means the fact; for, on the contrary, it frequently happens, that the man who had the firſt connection eſcapes, whilſt the other has all the ſymptoms of a very ſevere infection.

Several perſons may be bit, at the ſame time, by mad and poiſonous animals, ſuch as a mad dog, a viper, rattleſnake, &c. yet ſome are not at all or ſcarcely affected by it, although others die in conſequence of the accident. And, in the ſame manner, it frequently happens, that ſeveral perſons will go into infectious air, or into a room where there is a putrid fever, yet ſome eſcape, whilſt others receive the infection; and it ſometimes happens, that from inoculation, the infection is not received, nor does it always produce the ſmall-pox.

Theſe are facts, generally and univerſally admitted; and the cauſes of ſuch effects can be ſatisfactorily explained, by admitting the ſyſtem which I propoſe: whilſt, at the ſame time, theſe very effects furniſh ſtrong argument in favour of the lymphatics *abſorbing*, when they are *empty*, and not *at any other time.*

That the body does abſorb, when fatigued or exhauſted, there cannot be a doubt: it has been frequently obſerved by many medical writers, that the body is particularly ſuſceptible of abſorbing infection, when exhauſted: indeed it is a common ſaying, that a perſon coming off a journey, fatigued or exhauſted, is almoſt ſure to receive infection, if he ſhould go where there are putrid fevers or infectious air. Dr. Willis ſays, that perſons have received the ſmall-pox after very violent exerciſe. Dr. Huxham, in his Eſſay on Fevers, page 9, ſays, that it is dangerous to go abroad faſting, in the cold air of a morning, or on an empty ſtomach. And page 29, he ſays, that perſons who uſe a warm moiſtening diet, and warm relaxing diluents, counteract the effects of cold air, and eſcape ſuch diſorders as are common to cold weather. And in page 22, he ſays, that no perſon, very much fatigued, or faſting,

ing, ſhould enter into contagious air, or viſit ſick of a malignant or peſtilential fever. " I have known," ſays he, " this " fatal to many phyſicians; for then they " moſt readily receive the contagious efflu- " via or infection."

Dr. Hales, in his Vegetable Statics, ſays, " that a ſtrong young man, exhauſted by " labour and faſting, abſorbed, in the ſpace " of one night, eighteen ounces."

Mr. Cruikſhanks, page 100, obſerves, " that Profeſſor Home found himſelf " heavier in the morning, than he was juſt " before he went to bed in the preceding " evening, though he had been perſpiring " all night, and had received nothing, either " by the mouth, or in any other ſenſible " way. The Abbé Fontana alſo informed " me, that walking home ſome hours in " the open and damp air, immediately after " the operation of a purgative, that on re- " turning home and weighing himſelf " again, he was ſome ounces heavier; a cir- " cumſtance which cannot ſo eaſily be

" otherwiſe accounted for, than by ſup-
" poſing an inhalation from the atmo-
" ſphere. The celebrated De Haen, find-
" ing that his dropſical patients filled equally
" faſt, whether they were permitted to
" drink liquids or not, did not heſitate to
" aſſert, that they *muſt* abſorb from the at-
" moſphere. That the ſurface of the ſkin
" abſorbs other fluids, which come in con-
" tact with it, I have not the leaſt doubt.
" A patient of mine, with a ſtricture in the
" œſophagus, received nothing, either ſolid
" or liquid, into the ſtomach for two
" months; he was exceeding thirſty, and
" complained of making no water. I or-
" dered him the warm bath for an hour,
" evening and morning, for a month; his
" thirſt vaniſhed, and he made water in the
" ſame manner as when he uſed to drink
" by the mouth; and the fluid deſcended
" readily into the ſtomach."

With reſpect to the above obſervation of Mr. Cruikſhanks, concerning Profeſſor Home, I ſhould apprehend the Profeſſor was not fond of eating and drinking before he went to bed; if this was really the caſe, it is probable the lymphatic ſyſtem might be empty, and would readily account for the increaſe; for when the body is in a ſtate of emptineſs, there is not the leaſt doubt but it will abſorb and will be made heavier, in proportion to the ſtate of the atmoſphere as well as that of the body.

The increaſe of weight in the Abbé Fontana is readily accounted for, becauſe a great part of the lymphatic ſyſtem terminates in the inteſtines; and the operation of a purgative would empty, perhaps, the greateſt part of the lymphatic ſyſtem: and as the Abbé mentions particularly that the atmoſphere was damp, it readily explains in what manner the body became heavier.

The obſervation of De Haen is certainly a juſt one; for it is immaterial, in many inſtances, whether the patients are permitted to drink or not; for if it is denied by the *mouth*, you immediately put the *body into ſuch a ſituation*, that it will get it from the *atmoſphere*: and this is the circumſtance that appears to have puzzled De Haen to account for.

The laſt caſe mentioned by Mr. Cruikſhanks is very curious, and tends to prove the great power there is in the body to *abſorb* when *food is denied*; the longer a perſon has faſted, it appears that the power of *abſorbing is the more increaſed.*

I have heard that perſons at ſea, who have been caſt away, have been preſerved and kept alive by merely dipping and waſhing their bodies in ſea water, which was abſorbed in ſuch quantities, as to keep them alive for ſome time. Baron Haller, in his Phyſiologia,* ſays, that the ſemen is increaſed by eating and drinking, and is abſorbed by faſting and carried into the blood; and in chaſte people, who abſtain from venereal pleaſures, the ſemen muſt evidently be abſorbed and carried into the blood; for if it were to remain after its being ſecreted and accumulated, it muſt, by alteration or putrefaction, be productive of the worſt conſequences.

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* Elem. Phiſiol. lib. 27, ſect. 3.

It is likewiſe certainly true, that all other fluids in the body, as well as the ſemen, will be abſorbed and carried into the blood. I have found by experiments on myſelf, that by faſting for two or three days, and drinking very little fluid, the bile has been abſorbed and carried into the blood. It firſt appears on the tunica conjunctiva, or white of the eye, and afterwards it tinges ſlightly the whole of the ſkin with a yellow tinge, and a bitter taſte in the mouth, which I cured eaſily in a few hours, by drinking plentifully of tea, or any other weak liquid: and hence ariſes the cauſe of the bile tinging the neighbouring parts of the gall-bladder; which is ſuppoſed to tranſude in the dead body, but is by no means the caſe: nor is tranſudation peculiar to the dead body, as thoſe gentlemen think, who offer it as an argument in favour of tranſudation. The true reaſon of the bile tinging thoſe parts in the neighbourhood of the gall-bladder was the want of repletion to urge the fluids on through their natural paſſages; and therefore abſorption muſt always be the conſequence in *dead animals*. The longer the animal has been dead, the more the power of abſorption is increaſed; the bile is abſorbed and extended daily farther and farther from the gall-bladder, increaſing until putrefaction commences. And the ſame or ſimilar effects will be produced in the *living body* from *inanition.* I have particularly remarked in the ſmall-pox, when the eruptions have appeared full and turgid, and the patient does not drink diluents, that the matter is ſometimes inverted or abſorbed, and carried into the blood; and, in this caſe, it generally deſtroys the patient, or infects the blood ſo much, as to leave dreadful diſtempers, ſuch as ſcrophula, conſumptions, &c. but by uſing repletion plentifully, it entirely prevents the puſtules being inverted, or carried into the circulation. By the ſame means, I ſhould conceive it poſſible to confine the effects of inoculation to the particular part which is inoculated, and prevent its being carried into the circulation: but then, a queſtion will ariſe, namely, whether the patient will not be ſubject to receive the infection in the natural way afterwards? It is a curious queſtion, and deſerving of future conſideration. It is uſual to keep patients with a venereal buboe, or a collection of matter from any other cauſe, on a ſparing diet, the conſequence is, that the matter will be re-abſorbed and carried into the circulation; on the contrary, by eating and drinking, theſe effects are prevented.

Mr. Cruikſhanks has furniſhed us with another caſe, to prove that fluids are abſorbed at particular times: he obſerves, page 111, that "there is another fluid, "which the lymphatics alſo, on particular "occaſions, take up and carry into the "blood; I mean the urine. I am per"fectly confident of this, from attending "to what has happened to myſelf on a va"riety of occaſions. I have had the "ſtrongeſt calls to make water, and felt "that the bladder was full, but not having "it in my power to quit the company, the "ſymptoms, in ſome little time after, have "gone off: in an hour or two after, on at"tempting to make water, I found that the "bladder contained little or none. I have "not a doubt of the urine being abſorbed

" and carried into the blood veſſels. How " often the lymphatics may remove the " urine from the bladder, or why they do " not always abſorb it, in ſuppreſſions of " urine, I do not know: an uncommon " diſtention of the bladder may compreſs " the orifices of the lymphatics, and make " abſorption then impoſſible." This is common in large companies and hot rooms, where the air is heated, and the perſpiration great, and where there is nothing drunk; it is an obſervation that I have frequently heard from others, as well as remarked myſelf. In patients who have had a ſuppreſſion of urine, I have kept them free from pain, by not permitting them to drink liquids, by bleeding, and uſing aperient phyſic; the ſtricture, by this means, has ſoon been removed from the neck of the bladder, and the urine paſſed through the urethra the ſame as before the complaint; and this even in caſes where the ſtricture and inflammation on the neck of the bladder were ſo great, that all attempts to paſs a bougie or catheter proved ineffectual.

I have met with ſeveral inſtances where air, injected into the bladder of perſons in health, who have died of accidents, has paſſed from the bladder into the blood veſſels through the ſame paſſages, as what I ſhould conceive the urine to do in health when abſorbed.

It is not impoſſible but that the air might have paſſed through the ureters and kidneys, and by that means, into the blood veſſels; but I ſhould conceive that not to be the caſe: I am rather diſpoſed to ſuſpect, that the air paſſed through the lymphatic veſſels, which are inſerted into the bladder, and by that channel was conveyed into the blood. I conceive the ſurface of the bladder to be formed in the ſame manner as the ſurface of the veſica fellis, veſiculæ ſeminales, and every other ſurface or cavity of the body; and that whatever fluids are contained in or on them, muſt be liable, at particular times, to be abſorbed and re-conveyed into the blood; and this I conſider to extend to every part of the body: and that when the body is in a ſtate to abſorb in one part; it will abſorb in every other part.

It may be objected, that the lymphatics do not inveſt the receptacles containing the different fluids; as bladders that have been dried will hold the moſt penetrating fluids, ſuch as ſpirits of wine, turpentine, &c. without letting the fluid through; and that, therefore the lymphatics cannot open into their cavities. To this I anſwer, that there can be no apprehenſion of the fluids paſſing into the abſorbents, becauſe at the time theſe receptacles are filled with their fluids, the lymphatics are generally full alſo; ſo that the fluids would not, when the body is in this ſtate, find any admittance into them, but would be forced through the natural paſſages intended for them; and it is upon this general principle of repletion that all fluids are conveyed through their reſpective channels, and ſo diſcharged from the body. The glands and their excretory ducts are always fixed and ſtationary, ſo that whatever difference ariſes, muſt be from the quantity and quality of the contained fluid in the blood veſſels. But if we omit the cauſe that urges theſe fluids on, they will all be re-conveyed into the blood from all parts of the body.

I admit that a dried bladder will hold the moſt penetrating fluids, but this is no proof that there were no lymphatic veſſels inſerted into it when it was in the body; for when the bladder is dried, it is materially changed; and may then contain the moſt penetrating or ſubtil fluids, which it might not do when in the animal. We know that the ſkin of all animals is full of pores, yet when dried, or made into leather, it will hold penetrating fluids, without letting any through although there muſt have been ſuch pores in vaſt multitudes, when it inveſted the animal: and, beſides, it is a general principle, as will hereafter appear, that no part of the body whatever, can exiſt, without its being inveſted with lymphatic veſſels or membranes.

If medicines do not always produce the ſame effects, it is in conſequence of the different ſtate of the lymphatic veſſels; that is, whether they are full or empty at the time the medicine is taken; for the medicine ought to be always the ſame; but, in fact, it ſcarcely ever operates exactly alike twice together. If we intend a medicine to operate merely as an emetic, or a purgative, and that this medicine ſhould be confined to the ſtomach and inteſtines, we ought, previous to the taking ſuch medicines, to fill the abſorbent ſyſtem by diluents, otherwiſe the medicine will be carried into the blood, as appears from the effects of purgatives, mercurials, &c. which affect the milk, and produce the ſame effects in the child as in the mother. Hence ariſe the great uncertainty and difference in the effects of the ſame medicines, adminiſtered when the ſtate of the body is altered from inanition or repletion.

If we apply a large bliſter to the back, it frequently produces an inflammation of the bladder, which will be prevented by giving plenty of diluents previous to its application; that is, the barley water, or whatever may be uſed, will keep the lymphatic veſſels continually filled, ſo that none of the lymph or ſerum, impregnated with the cantharides, can enter the circulation.

The ſame or ſimilar effects ariſe from a ſimple gonorrhœa, where, from the irritation of the infectious matter, inflammation is brought on in the urethra: this is cured in a few days, by blending a few medicines with diluents; but if neglected, the diſorder goes on, and a confirmed lues very often the conſequence.

Where the blood is infected or diſeaſed, particularly in fevers of all kinds, our attempts to remove them will be fruitleſs in many inſtances, unleſs we apply liquids plentifully, ſo as to produce ſecretions from the blood, which ſhould certainly be the firſt conſideration; becauſe, without this, the infected blood will be retained in the body, and continually circulated, until the red globules become ſo much diſſolved, as to form livid, violet-coloured, or black ſpots, and fill the lymphatic ſyſtem in moſt parts of the body; and if a diarrhœa has not preceded them, they are generally followed by one, or hæmorrhages from the eyes, noſe, mouth, uterus, &c. and at laſt a bloody ſweat, and caries of the bones, if the miſerable patient ſhould live long enough, which is not often the caſe; notwithſtanding of our giving the bark,* and as many cordials as you pleaſe.

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* Geoffroy ſays, that the uſe of the Peruvian bark was firſt diſcovered by ſome Indians, who were ſeized with fevers, were extremely thirſty, and not being able to get any thing to drink, except ſome water in which had been ſteeped a tree, producing the Peruvian bark, that had been blown into it, they were ſoon cured of their fevers; and related it to others, who uſing the ſame means, were cured alſo: they afterwards made decoction of the bark, the effects of which they found to be the ſame. I am ready to admit the bark to poſſeſs all the virtues which it is aſſerted to have; yet I am inclined to believe that the Indians were greatly indebted to the water for their cure.

It, perhaps, may be objected here, that as the blood in putrid fevers is diſſolved, thin liquids will increaſe the diſorder by rendering the blood thinner; and that cordials and ſpecifics will prevent theſe effects. I can only anſwer, that I can produce the firſt medical authorities for giving weak liquids, even in putrid fevers; and, from what I have ſeen, and been able to obſerve, I am well convinced that it is the only method we can place any great dependence on, in order radically to extirpate any infection from the blood.

As the blood in putrid fevers is rendered as thin as water, there can be no apprehenſion of diluents making it thinner; but if we apply it freely in the beginning of the fever, a plentiful diſcharge of urine and perſpiration is produced, which will be kept up as long as we give diluents, and *prevent* the diſſolution of the blood which is better than *a cure of it.*

All acrimony producing chronical diſorders, ſuch as the gout, rheumatiſm, &c. is cured or relieved by liquids; in proof of which the many perſons who have been perfectly cured of inveterate complaints, by drinking plentifully of Bath, Buxton, or Tunbridge water, may be brought. I hope I have not expreſſed myſelf here, ſo as to be miſunderſtood. I do not mean to ſay, that medicines are uſeleſs, and that diluents will cure every diſeaſe; on the contrary, I know that there are many invaluable medicines, and that great good will ariſe from their being properly uſed. All that I mean, or intend to ſay, is, that whenever there is any infection in the blood, that the only means of radically extirpating it, is to combine our medicines with plenty of diluents; and, on the contrary, if we wiſh to prevent any poiſon from entering the blood, the ſame means muſt be uſed, which I am confident, in many inſtances, will be effectual.

I wiſh, before I cloſe theſe obſervations, to ſpeak a few words on the fever to which lying-in women are ſubject, the effects of it being ſo often fatal to them, is my only inducement to offer, what I firmly believe will be eſſentially beneficial; and will, in many inſtances, effectually exempt them from the effects of ſuch a cruel diſorder. Mr. Cruikſhanks has given, in a few words, the nature of the complaint; and I ſhall beg leave to quote it from him; he obſerves, page 110, that "after a woman "has lain-in ſome days, ſhe is ſometimes "taken with ſhivering, and other ſymptoms of fever; her milk diſappears, the "fever goes on, and ſhe dies. On opening the body, the cavity of the abdomen "has on ſuch occaſions been found full of "a whey-coloured fluid, mixed with laminæ of coagulated white matter. The "fever by many has in this caſe been "attributed to the abſorption of milk from "the breaſt, and its being carried into the "blood veſſels; believing the appearances "they ſaw in the abdomen to be from the "milk, they have given it the name of "*dépôt du lait*. I do not contend, that the "milk in this caſe is not abſorbed; but, "I believe, that milk would do no miſchief in the blood veſſels. The appearances in the abdomen are peculiar to the

" peritoneal inflammation, and would have " taken place, if the patient had been a " male inſtead of a female. The whey- " coloured fluid is the fluid of ſurfaces " increaſed in quantity, and mixed with " pus; and the curdled matter is the coa- " gulable lymph very conſtantly found " on inflamed ſurfaces.

The ſymptoms evidently point out the cauſe of this diſorder, and what I ſhould conceive muſt appear certainly to ariſe from abſorption. Can any thing be more expreſſive than the following words?— " After a woman has lain-in ſome days, " ſhe is ſometimes taken with ſhivering, " and other ſymptoms of fever; *her* " *milk diſappears, the fever goes on,* " *and ſhe dies.*" It does not leave a doubt in my mind, but that the complaint is produced from abſorption. The corroſive milk, combined with the fluids in the uterus, which alſo become changed from a mild to a malignant nature, being abſorbed, is ſufficient to cauſe the fever, and to deſtroy the peritoneum, (which I have ſhewn is an extenſion of the lymphatic veſſels,) and cauſe an extravaſation of its fluids in the cavity of the abdomen, and produce all the other dreadful ſymptoms, which are peculiar to the complaint.

I am of Mr. Cruikſhanks' opinion, that the abſorption of milk would produce no miſchief, whilſt it continued *ſweet*; but this it does but a very few hours; for after it has been confined for ſeveral days, it is no longer milk, but a virulent corroſive animal fluid; and ſoon demonſtrates itſelf to be ſo; as we may very frequently ſee a *fine breaſt* corroded away, leaving behind a horrid ulcer, occaſioned wholly by the milk, which was once ſo ſweet a fluid, being corrupted. I am alſo of opinion, that males would be liable to be affected in the ſame manner if kept on a low diet, and putrid fluids applied to theſe ſurfaces, which would deſtroy the parts from which they were abſorbed, and produce all the ſymptoms which we ſometimes indiſcriminately ſee in the peritoneal inflammation, &c. of both ſexes.

After a woman has been delivered, the body ſoon becomes in a ſtate to abſorb, and more particularly ſo at this time than at any other; becauſe we may recollect, that there has been a double circulation kept up for ſome time previous to the delivery, which muſt of courſe diſtend and fill the blood veſſels, and when the child comes into the world, it takes away with it a portion of the mother's blood, beſides what is loſt by floodings. From which it muſt follow, that the blood veſſels become relaxed, and contain a much leſs quantity of blood than what was contained in them, whilſt the double circulation was carried on: and hence it will alſo follow, that from this relaxed and empty ſtate of the blood veſſels, they will be diſpoſed in women, who are in this ſituation, to be particularly ſuſceptible of receiving fluids by abſorption.

To prevent this we muſt not undertake to do what is commonly called, ſtarving the fever: this low diet I have known to produce it and prove fatal to many young women, who have died with their firſt child from this cauſe. But, on the contrary, it will neceſſarily follow from what has been advanced, that every thing which tends to mild dilution immediately after delivery, is the only means we can depend on to promote ſecretions, and fill the breaſts with milk, which will be conveyed through its proper channel; and this will alſo prevent the abſorption of any unhealthy or corrupted fluids, and cure the patient.

Many other inſtances might be adduced as proofs of the body abſorbing when fatigued or exhauſted; and on the contrary, innumerable inſtances might be given, where the body will not receive infection at certain times; but I have already exceeded the limits which I at firſt intended, it is therefore hoped, that as this ſyſtem readily explains and elucidates many important things that are otherwiſe involved in difficulties inexplicable by any other means, but perfectly intelligible by the admiſſion of it, that what has been advanced will be conſidered ſatisfactory and concluſive; and that it will be juſt to infer, that the lymphatic ſyſtem, when *turgid* or *filled* with lymph, will not abſorb; as on the contrary, the ſame veſſels when *empty* immediately form a ſyſtem of abſorbents; ſo that from *inanition* or *repletion*, we can either put the body in ſuch a ſtate as to *receive* or *prevent* infection by *abſorption*.

CHAP. IV.

THE USE OF THE VALVES DEMONSTRATED.

THE valves are placed in many parts of the body; in the inteſtinal tube, in the veins, and in the lymphatic and lacteal veſſels, &c. They are formed from the internal membranes, or coats of the parts, from which they originate. They are generally of a ſemilunar or ſemicircular ſhape, whence authors have compared them to half moons, half thimbles, or the nails of the finger, &c. but their ſhape is ſometimes liable to change. Their number is very uncertain, and the diſtances between them very unequal; but they are commonly doubled or in pairs, and ſometimes one, two, or three pair together. This is very remarkable in the veins that ariſe from any very large gland, as of the ſpleen, pancreas, kidney, &c.

Of the uſe of the valves, authors have often been ſilent; Harvey, the diſcoverer of the circulation, ſays, that their uſe is to ſtop the blood that is driven with too much violence; others have ſuppoſed, that as ſoon as the blood had paſſed from the arteries into the veins, the valves might take off the force or preſſure of the blood from the arteries.

The generally received opinion at preſent of their uſe is, that after fluids have paſſed through tubes with valves, in one direction, they are prevented from returning; as the valves are ſuppoſed to ſhut up or cloſe the channel through which they had previouſly paſſed, and of courſe prevent their retrogradation.

Mr. Hewſon, page 17, remarks, that "The lymphatic ſyſtem, in moſt animals, "but particularly in man and quadrupeds, "is full of valves. Theſe valves have "been painted by the celebrated Nuck, "Ruyſch, and others, and are much more "frequent than in the common veins, and "thence theſe lymphatics have ſometimes "been diſtinguiſhed by the name of valvular lymphatic veſſels. Thoſe valves are "generally two in number, are of a ſemilunar ſhape, and the one is ſometimes "much larger than the other. In moſt "parts of the body theſe valves are ſo numerous, that there are three or four pair "in an inch of ſpace, but ſometimes there "is no more than one pair. They are leſs "numerous in the thoracic duct than in "the branches of the ſyſtem; thence it "might be ſuppoſed, that in proportion, "as we go from the trunk to the branches, "we ſhould find them thicker ſet: but "this is not always true, for I have obſerved them more numerous in the *lymphatic veſſels of the thigh*, than on thoſe "of the leg. When the veſſels are diſtended with lymph, they appear larger "where the valves are, which ſometimes "gives a lymphatic veſſel an appearance of "being made of *a chain of veſicles*; as "ſuch they are repreſented by ſome "authors.

Dr. Keill, p. 47, of his Anatomy, ſays, that " the lacteal veins have valves at ſe-" veral diſtances, which hinder the chyle " from returning back into the inteſtines." And he ſays in page 49, that " the " lymphe ducts are ſlender, pellucid tubes, " whoſe cavities are contracted at ſmall " and unequal diſtances, by two oppoſite " ſemilunar valves, which permit a thin " and tranſparent liquor to paſs through " them towards the heart, but which ſhut " like flood-gates upon its returning." And he farther ſays, page 322, that " In " all the veins which are perpendicular to " the horizon, excepting thoſe of the uterus " and of the porta, there are ſmall mem-" branes or valves; ſometimes there is only " one, and ſometimes there are two, and " ſometimes three placed together, like ſo " many half thimbles ſtuck to the ſides of " the veins, with their mouths towards the " heart. In the motion of the blood to-" wards the heart, they are preſſed cloſe to " the ſides of the vein; but if the blood " ſhould fall back, it muſt fill the valves; " and they being diſtended ſtop up the

" channel, ſo that no blood can repaſs " them."

Mr. Cruikſhanks ſays, page 63, that, " as ſoon as an abſorbed fluid has got a " little way within a lacteal or lymphatic, " it is prevented from returning by valves." And he farther obſerves, in the next page, that, " Valves are an apparatus nature employs frequently for the purpoſe of pre- " venting the retrograde motion of fluids, " but no where ſo much as in the cavities " of the lacteals and lymphatics." And a few lines farther on, he obſerves, that " A " valve is a ſemicircular membrane, or " rather of a parabolic ſhape, attached to " the inſide of the lymphatic veſſel by its " circular edge, having its ſtraight edge " correſponding to the diameter, looſe or " floating in the cavity: in conſequence of " this contrivance, fluids paſſing in one " direction, make the valve lie cloſe to the " ſide of the veſſel, and leave the paſſage " free; but attempting to paſs in the oppoſite " direction, raiſe the valve from the ſide " of the veſſel, and puſh its looſe edge to-

" ward the centre of the cavity: but, as
" this would ſhut up little more than one
" half of the cavity, the valves are diſpoſed
" in pairs, exactly oppoſite to each other,
" by which means the whole cavity is ac-
" curately cloſed. Their looſe edges are
" conſtantly turned towards the thoracic
" duct or trunk of the ſyſtem, ſo that fluids
" may paſs towards it, but cannot eſcape
" from it into the branches." And he alſo
remarks, page 65, that " it is not neceſſary
" to open the veſſels, in order to diſcover
" the valves; they are ſufficiently marked
" on the outſide, and give the veſſels the
" appearance of being notched or jointed
" in different places." And again—" In
" the lymphatic veſſels of quadrupeds this
" appearance is alſo very remarkable: nor
" is there the leaſt reaſon for cenſuring
" Ruyſch and Nuck on this ſubject, as
" having in their engravings very much
" exaggerated it."

The opinion of the valves preventing the retrograde motion of fluids is merely imaginary; it is an aſſertion or hypotheſis, in ſupport of which there has not been a ſingle argument or experiment advanced. Several ſtrong arguments, however, may be uſed to prove that the valves *do not* perform the office that is at preſent aſſigned to them; and other arguments may be adduced in favour of their being more extenſively uſeful, and making a very eſſential part of the mechaniſm of the animal œconomy.

It cannot be admitted, that after the fluid has paſſed the valves, that its mere weight could produce or cauſe ſo great a preſſure, or diſtention of the veſſels, as to give them that unequal or dilated appearance they have when diſtended with their fluids; as the force cauſing ſo great a diſtention muſt be much greater than what could reaſonably be ſuppoſed to ariſe from the *retrograde fluid in the tube.*

The valves are conſidered the principal criterion by which abſorbent veſſels are diſtinguiſhed, and are ſuppoſed to be eſſentially neceſſary to them alone, for the purpoſe of conveying their fluids *upwards* into the thoracic duct; but there are valves in tubes that are not abſorbent veſſels, and alſo in thoſe whoſe fluids *deſcend*, as well as in thoſe that *aſcend*; as for inſtance, the lymphatics that are diſtributed on the dura and pia mater, the brain, &c. If we ſuppoſe them to terminate in the thoracic duct, the fluids muſt *deſcend* from all thoſe parts that are ſituated above the termination of the duct, and of courſe the valves cannot be for the purpoſe of aſſiſting the fluids to *aſcend*; for if they did, the fluid could not poſſibly *deſcend* ſo as ever to get to the thoracic duct, (ſuppoſing it the termination of the abſorbent ſyſtem,) as the valves are ſuppoſed to cloſe up the tube ſo as to prevent the retrogradation of the fluid.

Now, it is a principle in hydraulics, that the weight of all fluids is ſufficient to make them deſcend; and, therefore, the valves, in all veins that return the blood from parts that are ſituated above the heart, would be uſeleſs; as the weight of the fluid is ſufficient to make it deſcend without them. The valves cannot, therefore, be conſidered as propelling abſorbed fluids upwards, becauſe veſſels that are not abſorbents, and thoſe, whoſe fluids *deſcend*, are equally ſupplied with them: and hence it appears, that the uſe of the valves is not for the purpoſe of conveying abſorbed fluids upwards, or preventing their retrograde motion.

As there are no arguments or experiments advanced in ſupport of the hypotheſis of the valves preventing the deſcent or retrograde motion of fluids, I ſhall proceed to ſhew that their real uſe is diametrically oppoſite to that of the prevailing opinion, and that their uſe is to reſiſt an impelling force. In ſupport of this I ſhall ſubmit the following conſiderations.

I beg to refer the reader to the letters quoted in the introduction of this work, which ſhew what was Dr. Hunter's opinion of the uſe of the valves. We ſhall frequently find him aſſerting that valves are placed where there is no impetus, or propelling force; now the contrary is the fact;

for wherever there is a propelling force, there is conſtantly a counteracting one by the valves, *and from this cauſe ariſe the different motions or circulation of our fluids:* this is preciſely analogous to muſcular motion; for wherever there is a motion by one muſcle, there is a reſiſting or counteracting one by its antagoniſt.

If we obſerve where the valves are placed, we ſhall conſtantly find an impelling force; for as there is an impelling force in the ſtomach, and in different parts of the inteſtinal tube, ſo there are valves placed to reſiſt it. As the chyle is preſſed* into the lacteals by the propelling force of the ſtomach and inteſtines, ſo there are valves in the lacteals to reſiſt it; the blood is propelled from the ventricles of the heart, and there are likewiſe valves to counteract it; and after it is impelled into the arterial ſyſtem, there are valves in the venal to reſiſt the force. The lymph is propelled into the lymphatic ſyſtem by the force of the heart and arteries, ſo the lymphatics have likewiſe their valves to reſiſt it; and in like manner in any other part of the body, where there are valves, there is always an impelling force, and the uſe of the valves is to counteract it.

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* It is evident that the chyle cannot be conveyed into the circulation by the power of abſorption alone; but is forced by the preſſure of the ſtomach, inteſtines, and the repelling power of the valves, through the lacteals into the circulation. It has been found to be conveyed into the blood ſurpriſingly quick; Mr. Cruikſhanks ſays, in ſome of his experiments on dogs, that the chyle was carried through the lacteals, at the rate of 20 feet in a minute; and farther adds, that he has ſeen at other times, the chyle vaniſh with almoſt incredible velocity, which appear to be proofs that the chyle is not conveyed into the circulation by the power of abſorption only, as many have imagined.

That the valves perform this office, there cannot be a doubt; their ſituation points out their uſe; for, when any fluid is to be urged on, or carried into different tubes; or ſeparations are to be made from the blood, there valves are found conſtantly placed to ſtop them in that particular part, and direct them into their proper channels. Thus, for inſtance, the valves are very conſpicuous in the veins that originate from the arteries, after they have formed glands, as may be ſeen in the veins that come from the glands in the axilla, ſpleen, pancreas, renal, proſtate, and inguinal glands; and likewiſe in the veins of many other parts of the body that ariſe from arteries after the gland is formed. Hence it appears, how very much Dr. Hunter and others were in an error, when they aſſerted, that veins in the viſcera have no valves, which is not the caſe, nor can I by any means admit ſuch an aſſertion to be true.

That the uſe of the valves are to counteract or reſiſt an impelling force, is farther confirmed by injections; for they will, even in dead bodies, reſiſt in one direction, but not in the other; and this reſiſtance will be conſtantly found to be diametrically oppoſite to that of the impelling force; as for inſtance, the valves in the veins are for the purpoſe of reſiſting the force of the blood, propelled by the heart and arteries; and if we inject the veins from the arteries with a force no greater than that with which the blood circulates in living animals,

mals,* the valves will make ſo great a reſiſtance, as to force part of the injection through the lymphatic veſſels and glands into the cellular membrane, &c. Hence anatomiſts have imagined, that their injections have been extravaſated into thoſe parts: but that opinion is erroneous; for the injection only paſſed through the natural paſſage of the lymph, and not by rupture. On the contrary, if the arteries be injected from the veins, the valves will make no reſiſtance, and readily let the injections paſs into the arteries: nevertheleſs, if much force is uſed, ſome of the injection may paſs into the cellular membrane, &c. through the glands.

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* When we conſider the great difference there is in the velocity of the circulating blood in the arteries, to that of the veins, which is, by Dr. Hales's experiments and obſervations, nearly as ſixteen to one, it muſt appear evident, that the valves reſiſt this force; otherwiſe there would not be ſo great a difference in the force or velocity of their fluids. It is probable that the veins would have a pulſation ſimilar to that in the arteries, if the valves did not reſiſt or counteract the force of the blood, from the artery into the veins.

The valves in the lacteals and lymphatics are for the ſame purpoſe as the valves of the other parts; and this is farther confirmed by the obſervations of anatomiſts, who continually remark, that they have injected the lymphatic veſſels *contrary to the valves*, by either getting them to give way, or by rupturing them; that is, when they have been injected contrary to the impelling force.

There is alſo a ſimilar organization in the vegetable creation; for plants are ſupplied with knots or valves; and this is very remarkable where there are new ſhoots or anaſtomoſing branches, their uſe being to ſtop fluids from proceeding in one direction, and to let them paſs into another; by which means the fluid is regularly diſtributed into every part; and it is remarkable, that where theſe knots or valves are placed, the plants are frequently larger by the fluids being longer retained in them. It is the ſame in animals; for as ſoon as the lymphatics paſs out of a gland, there are numerous valves, which by their reſiſtance preſs the fluid into all the neighbouring parts, before any of the other more diſtant can be ſupplied; and hence we find the lymphatic glands ſeated and inveſted with a conſiderable quantity of fat.

Therefore, the uſe of the valves is to reſiſt or counteract an impelling force, which is confirmed by their having that unequal or dilated appearance in thoſe parts of the tubes in which they are ſeated: and hence ariſes the cauſe of varix and rupture of the veins, which is generally the conſequence of old age, and is one of the principal cauſes of the decay of old people. The valves are of great importance to the organs of ſecretion; for as I have already obſerved, where the artery forms a gland, the valves are placed in that part of the vein which originates from the artery after the gland is ſo formed; and the purpoſe of this is to ſtop the fluids in that part; ſo that they may, by the propelling force with which they are conveyed, be urged through the glands, and be conveyed through the paſſages that nature has made for them; and hence it muſt appear, that as the force which the valves reſiſt muſt be conſiderable, theſe parts, like all others, muſt wear out. When this happens, the veins become much enlarged, dilated, and frequently ruptured; the conſequence of which will be, that the veins will no longer have ſtrength ſufficient to reſiſt the force of the arterial blood, which will paſs into the dilated veins, and little ſecretion being made from the blood, the body is deprived of the lymph, which will cauſe it to waſte and diminiſh in proportion to the deprivation of the lymph; which deprivation will depend upon the degree of reſiſtance, that the dilated valves and veins can make to the arterial blood, ſo as to urge the lymph through the glands into the various parts of the body.

It is alſo remarkable, that as we advance in life the arteries become ſmaller, and the veins grow larger; as the latter become enlarged they are unable to make the reſiſtance they formerly did to the arterial blood; and hence the arteries become ſmall and contracted. This is very conſpicuous in old perſons, where the veins have been much dilated, and the arteries thereby proportionally contracted.

By the valves, the lymph is urged into all the neighbouring anaſtomoſing branches; and by this means, if there be ſufficient fluid in the blood veſſels, the whole of the lymphatic ſyſtem will be filled. The valves alſo prevent the lymph from being extravaſated; for if it were not for their reſiſting and preſſing the fluid into the neighbouring parts, a rupture of any of the veſſels even in the extremities, would probably empty the whole of the ſyſtem; but by means of the valves, every part is firſt ſupplied with lymph, before it can arrive at the extreme parts; and if a lymphatic veſſel were ruptured in any other part of the body, every part, by the aſſiſtance of the valves, would be ſupplied with lymph before it arrive at the rupture; ſo that the lymph can only be extravaſated at this particular part, without depriving the neighbouring parts of their fluid. The farther importance and uſe of the valves will appear in the next Chapter.

CHAP. V.

OF THE SEPARATION OF THE LYMPH FROM THE BLOOD.

THE lymph is a fluid found univerſally diſperſed throughout the whole body. When we open an animal that has been juſt killed, we find the membranes, ſuch, for inſtance, as the mediaſtinum, pericardium, pleura, peritoneum, cellular membrane, as well as every other part of the body, moiſtened with it; and extending to the moſt minute parts of the body, as is clearly ſeen, when the lymph is tinged or coloured with blood, bile, &c. for it then appears more particularly ſo to extend, that no part, even ſo ſmall as a pin's point, can be ſeen free from the tinge throughout the animal.

There have been various opinions concerning the manner in which this fluid is ſecreted. The celebrated Boerhaave ſuppoſed there exiſted in an animal body three ſeries of arteries, carrying different fluids, viz. the ſanguiferous, ſeriferous, and the lymphatic; and that there was a ſyſtem of abſorbent veſſels connected to the veins, to convey the ſuperfluous lymph back to the heart. Others have been of opinion, that the lymph exhales from exhalent arteries in the form of vapour; but the moſt generally received opinion is, that it tranſudes through the arteries, which are ſuppoſed to have inorganized pores ſufficiently cloſe to retain the red globules, and to let the lymph tranſude. Albinus, Baron Haller, Dr. Hunter, and many other celebrated and eminent phyſiologiſts, have taught this doctrine of tranſudation; but as I have proved in the preceding obſervations, that tranſudation does not take place, either in the living or dead body, as theſe gentlemen have aſſerted; I ſhall here offer my opinion on the manner in which this important fluid is ſeparated from the blood, and ſo generally diſtributed throughout the body.

Secretion is performed nearly in the ſame manner throughout the whole of the animal œconomy. If we attend to the ſecretion of chyle, it will explain to us in what manner lymph is ſecreted from the blood.

In order to produce chyle, it is abſolutely neceſſary to eat and drink; theſe being the materials from which the chyle is made; and after the food is digeſted in the ſtomach, it is forced thence into the inteſtines. The chyle is then ſeparated from the groſs parts of the food, by the preſſure of the ſtomach and inteſtines; and by the aſſiſtance of the valves, it is prevented from paſſing through the inteſtines, until all the chyle is preſſed through the lacteals and thoracic duct into the blood. After it has got into the circulation,* the lymph is ſeparated from the blood, in a ſimilar manner to that in which the chyle had been before ſeparated from the ſtomach and inteſtines: as for inſtance, the heart urges on the blood into the arteries, in a ſimilar manner to what the ſtomach does the chyle into the inteſtines. Now, before the blood can be returned from the arteries into the veins, the valves, as I have more fully obſerved in the preceding Chapter, are placed in this part of the vein, to ſtop the blood; ſo that by the preſſure and force of the heart and arteries, and the reſiſtance made to it by the valves, the lymph is urged through the glands into the lymphatics; and by this means every part of the body is filled by the continual repetition of the preſſure of the heart and arteries, forcing the blood into the veins, in the ſame man-

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* If we compare the organization which ſeparates the *chyle*, with that which ſeparates the *lymph*, we ſhall find each of theſe ſeparations performed by ſimilar organs, with this difference only, that their ſhape is liable to vary; but the principle on which they act in both is preciſely the ſame: as for inſtance, if we compare

pare the termination of the thoracic duct, vena cava, and heart, with that of the mouth, œſophagus, and ſtomach, we find them both contrived to anſwer exactly the ſame purpoſe of repletion; and alſo if we further compare that of the blood veſſels, valves, glands, and lymphatics, with the inteſtinal tube, its valves, and lacteals, they appear to be equally well adapted to anſwer the purpoſe of ſecretion.

ner as the chyle had been previouſly preſſed from the ſtomach and inteſtines, and ſtopped by the valves until it had been preſſed through the lacteals and thoracic duct into the circulation; and this proceſs is repeated, until the lymph is ſeparated from the blood; after which the blood veſſels become relaxed, and return to the ſame ſtate they were in before repletion.

This doctrine of the ſeparation of the lymph being admitted, I ſhall be enabled very ſatisfactorily to explain ſeveral contradictions and difficulties that are to be obſerved in different authors.

Mr. Cruikſhanks, for inſtance, page 95, ſays, "The lymph is the fluid ſuppoſed by "the firſt diſcoverers of the lymphatics to "be found only in them, and not in the "lacteals, and which occaſioned their "forming theſe veſſels into two claſſes. "The truth is, the lacteals tranſmit chyle "when there is any chyle in the inteſtines; "and at all other times either tranſmit "lymph, &c. or are empty, and do not

“ tranſmit any fluid. The lymphatics “ commonly carry the lymph into the “ blood; but ſome of them may occaſionally alſo convey chyle, as I have demonſtrated in the lymphatics of the diaphragm. Neither the lymph then, nor “ the chyle are uniform fluids, but liable “ to conſiderable variation, and abſorbed “ only at particular times.” Here there is an evident contradiction; for the abovementioned author ſays, that “ the lacteals “ tranſmit chyle when there is any chyle “ in the inteſtines.” And in page 102, he ſays, “ If the end of an empty capillary “ tube is immerſed in a fluid, the fluid “ muſt riſe in it if it meets with no obſtruction; *but the extremities of the “ lacteals are often immerſed in chyle “ without taking up any of it*, as I ſaw “ in the orifices of the lacteals on the “ inteſtines; for ſome of the villi were “ loaded with chyle, whilſt others, almoſt “ in contact with them, were entirely “ empty.”

And Haller ſays, that it is no uncommon thing to ſee ſome of the lacteals filled on the meſentery, with a clear, pellucid liquor, whilſt others are filled with white chyle. He ſays, " Eodem etiam " tempore, in eodem animale, eodemque " meſenterio vaſa lactea in aliis inteſtinis " alba, diaphana in aliis non raro videas." Elem. Phyſiolog. lib. xxv. ſect. 1. And Dr. Hunter, in his Medical Commentaries, p. 42, where he relates the experiments that were performed by his brother on the inteſtines and meſentery of ſeveral different animals, ſays, that after having expoſed the inteſtines of a living dog, " we obſerved " the lacteals filled with a white liquor at " the upper part of the gut and meſentery; " but in thoſe which came from the ileon " and colon, the liquor was tranſparent." And again, in another experiment, he ſays, p. 44, " I opened the abdomen of a living " ſheep, *which had eat nothing for ſome* " *days*, and upon expoſing the inteſtines " and meſentery, we obſerved the lacteals " were viſible, but contained only *a tranſ-* " *parent watery fluid*." And he ſays farther,

ther, p. 45, that he "filled another part of "the inteſtine with milk. All that we obſerved after doing this was, that the lacteals became fuller, though not of a "white colour."

All theſe difficulties have principally ariſen from confounding the lymphatic and lacteal veſſels together; but as I have before ſhewn, that they are diſtinct and ſeparate veſſels, I ſhall immediately proceed to reconcile theſe miſtakes.

Firſt, If we feed an animal, kill, and open him ſoon after, we find the lacteals filled with chyle, and not the lymphatics.*

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* I do not mean to ſay, that the lymphatics will not convey ſome of the chyle through the glands of the inteſtines into the meſenteric veins; for I conceive that they do this in a ſimilar manner to the abſorbing power of the lymphatics, of other parts; particularly as there are inſtances of the blood in the meſenteric veins, having been found ſtreaked with white chyle; and animals, who have had the thoracic duct deſtroyed, have lived longer than they could reaſonably be expected to do, unleſs part of the chyle were carried into the blood by

Hence it appears, why ſome veſſels are filled with chyle, whilſt others of the *ſame part* are *empty*.

Secondly, If the animal be not killed until the blood veſſels have been ſufficiently

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by ſome other means, beſides the duct; and there are other inſtances where the duct has been diſeaſed, which has had all the appearance of long ſtanding: and that fluids paſs through the glands into the veins, is farther confirmed by the great quantities of thin liquids paſſing off by urine, in a very ſhort time after they had been drunk; ſo that from the ſize of the duct it would appear to be impoſſible that ſo much fluid could paſs through it in ſo ſhort a time.

Haller ſays, "Maxima vero eſt potatio aquarum "mineralium, quas intra per paucas horas vidi ad 200 "uncias exhauriri; alii viri etiam ultra eum numerum; "aliqui intra horas duas 40 menſuras cereviſiæ biberunt. Eas menſuras, ſi feceris 30 unc. quod "parum eſt, tamen ſunt in hora unciæ 150. Nunc "ductus thoracicus non multum lineæ diametrum "ſuperat, et non chylum ſolum, ſed omnem abdominis, et inferiorum artuum lympham revehit, "quam ex comparata magnitudine vaſorum lymphaticorum, quæ dixi, et lacteorum vaſorum ultimæ "claſſis, facile credas chylum copia ſuperare." Elem. Phyſiol. lib. xxiv. ſect. ii.

diſtended with chyle, ſo that the ſeparation of the lymph from the blood may commence before the whole of the chyle is conveyed into the blood veſſels: we ſhall ſee what Haller and others mention, viz. the lacteals conveying chyle from the inteſtines *into* the blood; and the lymphatics conveying lymph, which had been ſeparated *from* the blood, through the lymphatic glands, and veſſels, *and not, as is generally imagined, abſorbed from the inteſtines.*

Thirdly, If the animal ſhould not have been killed, until the whole of the chyle had been conveyed from the ſtomach and inteſtines into the blood veſſels, we ſhall only then ſee the lymphatic veſſels filled with lymph, which had been ſeparated from the blood. Mr. Hewſon has confirmed this; he ſays, page 10, "The lacteals begin
" from the inteſtinal tube, and can readily
" be ſeen in a dog or other quadruped that
" is killed two or three hours after eating,
" when they appear filled with white chyle.
" The experiment ſucceeds beſt when the
" dog is fed with milk; but they do not
" always

“ always convey a white fluid, *for even in*
“ *a dog, if opened long after a meal, they*
“ *are found diſtended with a liquor that is*
“ *tranſparent and colourleſs like the lymph.*”

Fourthly, If the animal has not been fed for ſome time previous to its being killed, neither lacteals nor lymphatics will be filled with their fluids; they will then be in a ſtate of abſorption only to receive their fluids, as long as they remain in that ſtate; but the lymphatics in dying animals, that are in pain, are frequently found filled with a clear fluid, which had been preſſed into them by the contraction of the heart and arteries, and not abſorbed from the inteſtines.

The lacteals are prevented from abſorbing by repletion, as well as the lymphatics: this is obſervable in gluttons who overload their ſtomach, ſo that there is more chyle made than what the blood veſſels can contain; which being ſo diſtended, that they cannot receive any more, they are generally relieved by nature, which diſcharges from their ſtomach, what they have been ſo greedy to put into it; or elſe they are relieved by a diarrhœa from the inteſtines; or, if a quantity of water be taken into the ſtomach, the lacteals will convey it into the blood, as long as the blood veſſels can conveniently contain it; but as ſoon as they are filled to a certain degree, part of the fluid is returned back again into the ſtomach, which is forced out of the mouth by vomiting; and the lacteals will not receive any more, until the blood veſſels are relaxed and emptied by ſeparations from the blood.

If we attend to the ſtate of the blood veſſels, we ſhall be able to account for the chyle being conveyed quicker into them at one time than at another; a circumſtance which Mr. Cruikſhanks has obſerved; for he ſays, page 29, "The chyle in the lac-
" teals of the meſentery of dogs, in ſome
" of my experiments, evidently run through
" a ſpace of four inches in a ſecond, which
" is twenty feet in a minute. I have at
" other times ſeen the abſorbed fluids vaniſh
" with almoſt incredible velocity: ſo that
" little can be concluded on, againſt the
" poſſibi-

" poſſibility of the fluids mentioned, being
" abſorbed by the lacteals, or tranſmitted
" by the thoracic duct within the aſſigned
" periods."

I ſhould apprehend, that in animals that have been kept without food for ſome time, the chyle would be preſſed very rapidly through the lacteals, becauſe there would be no reſiſtance from the relaxed ſtate of the blood veſſels by emptineſs; and this motion of the chyle would be proportionally diminiſhed, as the blood veſſels became fuller, till at laſt the lacteals will not receive any more; and, if forced, a vomiting would be the conſequence.

I cannot admit that the lymphatic veſſels are filled with lymph, in the manner that is generally thought. Mr. Hewſon, page 11, ſays, "The courſe of the lymph, like that
" of the chyle, is from the extreme parts
" of the body towards the center, and the
" lymphatic veſſels commonly lie cloſe to
" the large blood veſſels. If, therefore, a
" ligature be made round the large blood
" veſſels

" veſſels of the extremities of a living animal, or one juſt dead, that ligature, by "embracing the lymphatics, will ſtop the "courſe of the lymph, which, by diſtending the veſſels, will make them viſible "below the ligature." And Mr. Cruikſhanks, page 60, ſays, "The abſorbents "appear to me to have a ſimilar power of "action, and to be capable of abſorbing "for ſome time after the animal is dead. "Malpighi had before ſaid, that one would "be tempted to believe that they abſorbed "after death, and I was determined to "make the experiment: I tied up the "trunks of the arteries and veins belonging "to a portion of the great inteſtine in an "aſs, which had been dead a few minutes, "(the inteſtines were ſtill in the cavity of "the abdomen, and the parts not cold.) I "knew that the trunks of the abſorbents "muſt be incloſed in the ligature, though "not one of them was then viſible. Two "hours after I returned, and found a number of abſorbents turgid with a tranſparent fluid. I opened one of the largeſt "with a lancet, the fluid iſſued out in a

“ ſtream, which it could not have done, “ unleſs the veſſels had continued to abſorb, “ and to propel their fluids with great force “ after the death of the ſyſtem.”

The cauſe of the filling the lymphatics does not, as theſe gentlemen think, ariſe from a ligature incloſing the abſorbents, ſo as to prevent the lymph getting into the thoracic duct.

The arteries, it is admitted, have a muſcular power which remains a conſiderable time after death; now if we incloſe the arteries and veins in a ligature, the arteries, by their muſcularity and contraction, which is much increaſed in animals in pain, or that are dying, will force the blood into the veins; the conſequence will be, that as the blood cannot paſs the ligature on the vein, the lymph will be forced into the lymphatic veſſels through the glands, which will become turgid with lymph, and ſometimes with blood. This is farther confirmed, by obſerving the effects of any thing that can cauſe a preſſure or tenſion of the blood veſſels, which will produce an immediate ſeparation of lymph from the blood; whether it be cauſed by paſſion, fear, anger, exerciſe, fits, &c. which always increaſe the ſecretions, as may be obſerved from the quantity of urine, perſpiration, &c. In all theſe inſtances there is a palpitation of the heart, which propels the blood with greater violence into the arteries, than at other times; therefore, whether we cauſe a preſſure or increaſed motion in the blood, either by repletion, paſſions, or ligatures, the effects are the ſame; liable only to different degrees, according to the violence which is uſed to produce them, and as ſoon as the cauſe is removed, the effects will ceaſe. It is on this principle that the legs of pregnant women ſwell, which is cauſed by the preſſure of the child, in the uterus, on the veins, which require an increaſed force from the arteries to propel the blood back into the heart; this effect at the ſame time cauſes an increaſed ſeparation of lymph, and the legs to ſwell, which goes off as ſoon as the cauſe which produced it is removed.

Dr. Lower made a ligature on the cava inferior of a dog; it occaſioned an aſcites, that is, the arteries propelled their blood into the veins with ſuch force, as to preſs the lymph through the lymphatic glands and veſſels into the cavity of the abdomen. Mr. Hewſon ſays, he repeated this experiment, but as the dog died half an hour after, there was only a ſmall quantity of water in the abdomen. Dr. Lower relates another experiment: he tied up the jugular veins of a dog, and the dog's head became dropſical; this was cauſed in the ſame manner, by forcing the blood from the arteries into the veins; for when the principal trunk of the jugulars is tied, the force from the arteries muſt be great, and cauſe a conſiderable diſtention of the collateral branches of the veins, and muſt alſo frequently cauſe a preternatural ſeparation of lymph.

Mr. Hewſon thinks there muſt be ſome fallacy in theſe experiments, which he does not conſider ſatisfactory, becauſe he ſays, that he tied up the jugular veins, and even in one dog cut out both the external jugulars, and kept him a twelvemonth afterwards, without any appearance of an œdema having been produced; and alſo quotes Baron Van-Swieten, who tied up the jugular veins of a dog, which did not produce any ſymptoms of a dropſy. He then ſays, page 144, "I ſhould therefore ſuppoſe that "in Lower's experiment, not only the "veins, but the lymphatic veſſels which "lie near them, had been tied; in which "caſe, the lymphatics would burſt and oc"caſion theſe ſymptoms" (meaning the dropſy in the head): "but in my experi"ments I took care to ſeparate the vein "from the lymphatics."

Theſe experiments are far, in my opinion, from proving thoſe of Lower's unſatisfactory. The tying the jugular veins may not always produce a dropſy; for if the blood veſſels ſhould not be full at the time the ligature is made, (which is a circumſtance I ſhould conſider very material in the experiment) the collateral branches, forming innumerable anaſtomoſes, may be ſufficiently large to return the blood without cauſing ſuch a diſtention, as to fill the head with ſo much water as to kill the animal. On the other hand, if the animal had been previouſly fed, and the blood veſſels diſtended, before the ligatures were made, it is probable that there might be ſo much lymph preternaturally forced through the lymphatic glands and veſſels, as to cauſe a dropſy in the head. Mr. Hewſon erroneouſly imagines, that his taking care to ſeparate the lymphatics from the blood veſſels, before he applied the ligature, was the cauſe of preventing the dropſy; the true reaſon was, that the blood veſſels were in different ſtates at different times, and the anaſtomoſing branches more or leſs numerous.

Mr. Cruikſhanks, p. 11, obſerves, "The
" ſweat or the fluid found on the ſurface of the
" body, and which comes more immediately
" under our obſervation, is found in greater
" quantity at one time than another. This
" increaſe of quantity is evidently connected

" with greater force in the heart and arteries, " propelling the fluids, as we ſee after violent exerciſe. Now theſe facts correſpond " better with the theory which ſuppoſes " organized orifices, or that the mouths of " the exhalent arteries terminate on ſurfaces; for, as the force is greater which " propels the fluids, theſe orifices muſt be " in proportion diſtended; and the fluid " being alſo propelled with greater velocity, " we can eaſily conceive how the ſecretion " ſhould be increaſed. On the other hand, " that copious cold ſweat which takes place " on fainting, appears to depend on the " greater relaxation of theſe exhalent orifices permitting the fluids to eſcape: but " on the principle of tranſudation, which " muſt ſuppoſe the fluids and filtre to be " almoſt always in the ſame ſtate; theſe " phænomena are abſolutely inexplicable."

The cauſe of all natural ſeparations from the blood is the preſſure produced by repletion: now, as the motion of the blood is accelerated by a continuance of the impetus, which is an increaſe of the fluid contained in the veſſels, it will neceſſarily follow, that the more we fill them, the greater will be the preſſure, and greater the ſeparations made from the blood. That the pulſe is quickened or diminiſhed by repletion or inanition, is demonſtrated to be a fact; for in animals that have been bled to death, the pulſation of the arteries have been generally found proportionally to diminiſh, as the blood veſſels became more and more emptied; and when all the blood has been let out of the body, the pulſe ceaſes to beat. If we inject a fluid into them, they will vibrate again, and quicken as we increaſe the fluid: this is alſo farther confirmed by attending to the ſtate of the pulſe before and after meals; the pulſe before dinner is weak and languid, but as ſoon as the chyle begins to be conveyed into the blood veſſels, the pulſe quickens amazingly, the body grows warm, and the veins become turgid with blood. This increaſe of the blood produces ſuch a diſtention, as to cauſe all the ſeparations from the blood that are neceſſary for our exiſtence; but after the purpoſes of nutrition are anſwered, the veſſels return to the ſame relaxed ſtate as they were in previous to repletion. As to the cauſes of ſeparations from the blood, otherwiſe than by repletion, theſe will be in general found to be the paſſions, ſuch as, anger, revenge, fear, anxiety, fits, &c. as formerly mentioned. In all theſe ſituations there is a conſiderable agitation, anxiety, and a palpitation of the heart and arteries, ſo that the blood is quickened in a greater or a leſſer degree; and there is alſo evidently a certain degree of pain: and all pain creates a contraction of the muſcular parts of the body, as well as of the heart and arteries. Whatever we apply to a living part that gives pain, produces a contraction; and we may even obſerve this power of contraction in all dying animals: this is ſufficient to empty the arteries and force the blood into the veins, and the lymph through the lymphatic glands into the lymphatic veſſels, which are found turgid with lymph, and ſometimes with blood, in ſtrangled animals.

We frequently find the arteries nearly emptied of blood; and Haller ſays, that the lacteals, even after the death of the animal, expel the chyle, ſo that the veſſels become pellucid, which before were milky. This is certainly a miſtake; for it is not chyle that fills the lacteal veſſels from the inteſtines, but it is the arteries that, from their contraction, fill the lymphatic veſſels with lymph. Therefore, whether the preſſure on the blood is cauſed from a diſtention of the blood veſſels by repletion, or whether the preſſure is cauſed by a contraction of the heart and arteries, from paſſions, &c. on the fluid, I ſhould conſider very immaterial; as the ſeparations, in both inſtances, are cauſed from preſſure; one from repletion, and the other from contraction.

I am aware that the following difficulty may be urged as an objection to the lymph being ſeparated from the blood, through the lymphatic glands, namely, that upon drinking a greater quantity of liquids than uſual, inſtead of their being carried off by the kidneys, they would eſcape into the cellular membrane, and occaſion an anaſarca: to this I anſwer, that it is not an objection that can be conſidered as peculiarly applicable to the ſyſtem which I propoſe; becauſe, whether we conſider the fluid found in the different parts of the body to tranſude through the arteries, in conſequence of inorganized pores, or imagine it to be ſeparated by exhalent arteries; or whether it paſſes through the lymphatic glands into the ſurfaces and cavities of the body; the ſame objection is equally applicable to each of theſe opinions, and it has always been conſidered as an inexplicable difficulty. I ſhall, however, offer the following reaſon why it is almoſt impoſſible that a dropſy can be produced, by drinking more at one time than what we do at another:—The blood veſſels will only contain a certain quantity; if forced, they reject it by vomiting: but ſuppoſe we ſhould not drink ſuch a quantity of liquid as to force the ſtomach to reject it, yet we may, by continually keeping the blood veſſels filled to a certain degree, cauſe a continual ſeparation of the fluids; for we we may obſerve, on theſe occaſions, that the perſpiration, urine, &c. is in proportion to the quantity drank: now, if it were poſſible for us to continue drinking in this manner for any conſiderable time, there can be no doubt but an anaſarca would be the conſequence. Dr. Hales, in his Hæmaſtatics, has ſatisfactorily demonſtrated this to be the fact. But Nature has done every thing by weight and meaſure, and has limited us to a certain quantity, which it is not in our power to exceed; for as ſoon as we have drunk ſo much as to cauſe any great or preternatural ſecretion, the fluid ſeparated in the ventricles of the brain cauſe ſuch a compreſſion on the cerebellum, as to take away all ſenſation for ſome time, until the cauſe be removed, and puts it out of our power to do ourſelves any very eſſential injury; although, now and then, there have been inſtances of perſons getting ſo extremely intoxicated, that it has been fatal to them. The power of ſenſation does not return until the ſuperfluous fluids have been exhauſted by perſpiration from the ſkin, lungs, urine, &c. and leaves us in a ſtate ſo weak and languid, as to take away any inclination of ſubjecting ourſelves again to a ſimilar ſituation.

Hence we cannot conveniently either eat or drink more than is ſufficient to repair the loſs that is continually made, unleſs we force our inclination; for Nature has taken care to point out to us, by the intimations of hunger and thirſt, the proper times of repletion: this being accompliſhed, theſe ſenſations do not return until all that has been previouſly taken is carried off, and then repletion becomes again abſolutely neceſſary for our exiſtence. It is the ſame with moſt animals; if you always let them have as much as they will eat and drink, they, in general, will not take more than is neceſſary to ſatisfy ſuch wants, for they only become ravenous from being deprived of it; although ſometimes, indeed, their ſenſations are depraved from diſeaſe, and they may then, perhaps, take more than is neceſſary to repair the parts that are continually paſſing off from the lungs by perſpiration, urine,* &c.

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* Sanctorius, a celebrated Italian phyſician, whoſe ſtatical experiments were conducted with great patience,

But as long as any lymph is ſeparated from the blood into the ſurfaces and cavities of the body, it takes away the ſenſation of hunger and thirſt. So long as this or any other fluid remains in the ſtomach, there is no ſenſation of hunger, for it is only produced by its being empty. Hunger is immediately removed by drinking any fluid; and hence ariſes another cauſe why the lymph ſeparated from the blood, on and in the different ſurfaces and cavities of the

patience, preciſeneſs, and accuracy, has demonſtrated, what has been confirmed by modern obſervations and experiments, that the quantity of fluid exhaled from the ſkin and lungs, amounts to nearly 5-8ths of the food which we eat and drink; ſo that, if the quantity eat and drank amounts to eight pounds in one day, five pounds will be carried off by perſpiration, and only three pounds by the other evacuations; but this is liable to very conſiderable variations, according to the temperature of the atmoſphere; in hot weather, more goes off in perſpiration; in cold, more by urine; ſo that by either the evacuation one way or the other, the quantities exhauſted are nearly the ſame; for if it is denied a paſſage by one means, it finds it by another; and this may be confirmed very ſatisfactorily by attending to the evacuations from our bodies, under various changes of the atmoſphere.

body, cannot produce a dropſy; for, in health, as long as any lymph remains, we have no deſire to eat or drink, as its being there deprives us of thoſe ſenſations, which only return when this important fluid is exhauſted. Nature has many reſources to prevent her operations from being defeated; ſhe has appointed intimations when we do right and wrong, and if we deviate from them, ſhe compels us to attend to her dictates; for, if we eat more than is proper for us, ſhe will diſcharge it from our ſtomachs, notwithſtanding all our endeavours to the contrary. And again, if we drink too much, ſhe will ſend us to ſleep.

The ſeparation of the lymph, then, is cauſed by the preſſure produced from repletion, and the reſiſtance of it by the valves; and an immediate ſeparation from the blood may be cauſed by any *compreſſion* or *contraction* of the blood veſſels on the contained fluid; and the ſeparation will be in proportion to the quantity and quality of the blood at that time in the veſſels, and the force of the contraction.

CHAP.

CHAP. VI.

OF THE PROPERTIES AND USE OF THE LYMPH.

THERE have been formed ſtrange and various conjectures concerning this fluid, and the little that has been known of its properties, is from modern experiments and obſervations. It has been diſtinguiſhed by variety of names, ſuch as *ſuccus nutricius*, *nervous fluid*, *animal ſpirits*, *the ſoul*, *æther*, *water*, *coagulable lymph*, &c. neither are authors agreed concerning its colour, conſiſtence, or properties; from which, perhaps, have ariſen more ſtrange conjectures and controverſies, than from any other part of phyſiology.

Some have aſſerted, that it is of a yellowiſh, reddiſh, or purple colour; others, that it is tranſparent and colourleſs: it may have appeared in all theſe different colours; it may have been tinged with bile, which will give it a yellow caſt; it may be mixed with blood that has been diſſolved or putrid, ſo as to have a red or purple colour, which, I apprehend, was alſo the reaſon of ſome of the old writers aſſerting, that the nervous fluid was of a red or purple colour. But all theſe are preternatural appearances, from the lymph being impregnated with other fluids, and from diſeaſe; and are not to be obſerved when it is examined in a healthy ſtate, for it then appears clear, pellucid, and colourleſs, which is its natural appearance; although it will, ſometimes, if examined in animals that have been fed, previous to their being killed, be a little turbid, as if it had been mixed with a ſmall quantity of milk. This, I apprehend, is cauſed by its being impregnated with a ſmall quantity of the white chyle paſſing through the lymphatic glands with it: but this is an appearance that only happens now and then, and after the animal has been juſt fed; but at all other times it is clear and tranſparent.

There have been likewiſe many opinions concerning the conſiſtence of it; ſome aſſert it to be thick; others, thin, or a mere water; others, that it is a ſtrong jelly: but it is liable to have all theſe appearances, under different circumſtances of health and diet. If an animal is fed on bread and water, the lymph will be proportionally thin and watery; and, on the contrary, by repletion with nutritious diet, it may be made as thick and clammy as glue, which is frequently the caſe in a pleuriſy, where the lungs often adhere to the pleura: it, therefore, ſeldom remains in the ſame ſtate or conſiſtence, for it is liable to be made a mere water, or a ſtrong jelly, whilſt the animal is in health.

Mr. Hewſon's experiments and obſervations on this ſubject are ſo juſt and appoſite, that I ſhall quote a few pages from them:

He ſays, page 165, "We have always "found the fluids contained in the different "cavities of the body, and that contained "in the lymphatics, exactly agreeing with "one another in their tranſparency, in their "conſiſtence, &c. And in animals in

" health we likewiſe found, when the one " jellied on being expoſed to the air, the other " did ſo too: and in the animal reduced by " low diet, where the properties of the one " were altered, thoſe of the other were ſo " likewiſe, and exactly in the ſame manner." And in page 104, he ſays, " If immediately " after killing an animal in health, a lymphatic veſſel be tied up properly, and " then cut out of the body and opened, ſo " as to let out the lymph into a cup and " expoſe it to the air, it will jelly as the coagulable lymph of the blood does in the " ſame circumſtances: this is an experiment " I have likewiſe made ſeveral times on " dogs, aſſes, and geeſe." And in p. 107, he obſerves, " But what is a more curious " fact, in thoſe caſes where I have compared the fluid contained in the abdomen " and pericardium, with that contained in " their lymphatic veſſels, of animals in different ſtates of health, I have always " found them to agree with one another, in " the degree of coherence of the jelly which " they formed; for, when the animal was " in perfect health, the lymph from the

" cavity of the pericardium, abdomen, and
" pleura, formed a ſtrong jelly; and that
" in the lymphatics in the neck and extremities
" was equally firm; when the animal
" was reduced, as in the dog fed eight
" days on bread and water, or when the
" gooſe was very young, then the jelly,
" formed by the fluid collected in theſe
" cavities, was weak; and that formed by
" the lymph in the lymphatic veſſels, was
" likewiſe weak in the ſame proportion:
" ſo that although theſe fluids vary in the
" different circumſtances of health, yet they
" always agree with each other."

Theſe obſervations are certainly of the utmoſt conſequence, and deſerve to be particularly attended to; for they prove, that the fluid found in the *lymphatics*, and that on the different *ſurfaces* and *cavities*, is the ſame throughout the body; and alſo ſhew how very liable the conſiſtence of it is to be continually altered or changed, from a thin weak fluid up to the ſtrongeſt jelly: alſo, that there may be intermediate degrees of conſiſtence continually taking place in the animal œconomy, from the different qualities of our diet affording a greater or leſs quantity of this nutritious fluid, as it is found to be the ſame univerſally throughout the body. They alſo prove, that when the fluid taken from one part jellied, on being expoſed to the air,* the ſame appearances were to be obſerved in the other parts; ſo that whatever alteration happened with reſpect to the different degrees of its conſiſtence in one part, the ſame took place in the other parts of the body likewiſe.

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* We are liable to take cold when going into the cold air out of warm rooms, and particularly after meals; the lymphatic ſyſtem is then filled with lymph which has been ſeparated from the blood; it coagulates from cold in the lymphatic veſſels, which cauſes an obſtruction in the lymphatic ſyſtem; this is generally attended with a quick pulſe and fever, which, by drinking weak liquids and a ſmall quantity of antimony, will be effectually removed, but, if neglected, it may be attended with ſerious conſequences; for every hour the lymphatic ſyſtem remains obſtructed, it becomes more and more dangerous; as the heat and fever increaſes, the lymph, like all animal fluids which are confined, is continually changing towards a ſtate of putrefaction, and, if abſorbed, may produce a putrid fever, and deſtroy the perſon.

Mr. Cruikſhanks ſays, that Mr. Hewſon's experiments did not ſucceed with him. He obſerves, page 97, that " The arteries, or
" perhaps certain other veſſels ariſing from
" them, and known commonly by the
" name of exhalents, are conſtantly throw-
" ing out a fluid into all cavities of the
" body ; this fluid keeps the ſurfaces moiſt,
" and makes motion eaſy, by allowing
" them to ſlide eaſily upon one another.
" This fluid, however, would accumulate
" in ſuch quantity, as to produce dropſy
" of all thoſe cavities, if the lymphatics
" were not conſtantly abſorbing it: now,
" though this alone is a very important
" function, nay, abſolutely neceſſary to
" the continuance of the animal machine,
" I ſuſpect that the lymph is a fluid more
" extenſively uſeful, and that this is not all
" that is meant by making the lymphatics
" take it up ; I ſuſpect, that the fluid found
" in the lymphatics is, in part, the coagu-
" lable lymph of the blood ; the fluid on
" ſurfaces

" ſurfaces never appeared to me to have that
" property which the lymph has, of coagu-
" lating from extravaſation, or from reſt,
" in the dead body. Mr. Hewſon's expe-
" riments, by which he believed that he
" proved, that the fluid on ſurfaces, and
" the fluid in the lymphatic veſſels, were
" the ſame, never ſucceeded with me. He
" uſed to ſcrape, with a wet ſpoon, the
" ſurface of the peritonæum or pleura, till
" he had collected ſome conſiderable quan-
" tity of fluid: on letting it ſtand, he found
" that ſoon after it coagulated; and he con-
" ſidered this as ſtrong a proof of the lym-
" phatics abſorbing from ſurfaces, as the
" chyle's being white and coagulating in
" the inteſtines, and being of the ſame
" colour, and having that property in
" the lacteals, was a proof of their ab-
" ſorbing it from the inteſtines. This ex-
" periment is liable to deception. In ſcrap-
" ing theſe ſurfaces, veſſels, containing a
" coagulating fluid, may be torn, and it
" may not be the fluid of ſurfaces which is
" thus collected: beſides, the liquor of the
" pericardium and the ventricles of the
" brain, and of the tunica vaginalis teſtis,

" which

"which are analogous fluids, never coagu-
"lated, in any of my experiments, under
"a leſs heat than that of 140 or 160 of
"Farenheit's thermometer: beſides, the
"quantity of lymph in the lymphatic veſ-
"ſels is greater than we could ſuppoſe it to
"be, were it only the fluid of ſurfaces.
"Whether, therefore, they abſorb it from
"the cavities of the blood veſſels, as from
"ſurfaces in common; or whether they
"ariſe alſo from the extremities of arteries,
"as Bartholine aſſerted, I do not know;
"I am rather diſpoſed to think the lym-
"phatic vaſa vaſorum may take coagulable
"lymph from the cavities of the blood veſ-
"ſel for ſome purpoſe yet unknown." And in page 72, he conſiders the fluid found in the lymphatic glands different to the abſorbed fluid: he ſays, "This fluid in
"the microſcope appears to have globular
"particles in it, ſimilar to thoſe which, by
"the ſame means, we diſcover in milk.
"It is moſt probable this fluid is there ſe-
"creted by the arteries, and is totally diffe-
"rent from the abſorbed fluids, or thoſe
"paſſing through the proper cells of the
"glands. Had it been found only in the

" glands of the meſentery, we ſhould have
" ſuſpected it, both from its colour and
" containing globules, to be the chyle;
" but it is found in all glands, even in thoſe
" which are at the greateſt diſtance from
" the meſentery, and out of the road of the
" chyle. Mr. Hewſon ſuſpected, that
" theſe globules became afterwards the red
" particles of the blood. This he inferred,
" not only from the globules, but alſo from
" the circumſtance of the fluid being in
" *greater quantity in young animals, where*
" *more blood was wanted; and its diſap-*
" *pearing in old age, where leſs blood was*
" *wanted, where new parts were no longer*
" *forming, and the ſecretions every where*
" *diminiſhed. The fact is, we do not know*
" *what is the uſe of this fluid.*"

After what has been advanced, it will not be difficult to reconcile theſe differences, particularly as I have ſhewn, and even from what Mr. Hewſon has himſelf obſerved, that the lymph is in a continual progreſſive ſtate, and that its qualities and conſiſtence are very different at one time, to what they are found to be at another; and that it is almoſt impoſſible to find them exactly alike, even in the ſame animal, in different circumſtances, unleſs we prepare the animal on purpoſe; and even then, although the lymph will always jelly, yet the ſtrength of the jelly will be liable to vary, according to the nature, quantity, and quality of the food which the animal had been previouſly fed with. If Mr. Hewſon had really, in ſcraping the ſurface of the pleura, or peritonæum, ruptured or torn any veſſels, or their membranes, with the ſpoon, I ſhould certainly conſider it no objection; becauſe it is more than probable that the fluid they contained would be the ſame kind of fluid that is found on their ſurfaces. Of this, I think there cannot be a doubt, as Mr. Hewſon's experiments, he ſays, were many times repeated, and the reſult always the ſame, which is a ſufficient proof, and appears to me to be perfectly ſatisfactory and concluſive.

Neither can there be a doubt, that the lymph will be longer coagulating at one time than another; and at ſome particular times, when it is deprived of its nutritious particles, no part of it will coagulate when expoſed to the air, or held over the fire, but will evaporate like water. Neverthelefs, this alteration is no objection to its being conſidered as the ſame general fluid which extends all over the body.

I ſhould conſider the lymph, deprived of its coagulable matter, to be a mere water; and that the different degrees of conſiſtency, which it undergoes in health, ariſe merely from the quantity and quality of the animal, and vegetable juices, &c. with which it is mixed or impregnated, and which form the jelly or coagulable matter: for as the water is impregnated, more or leſs, with nutritious particles, ſo will it form a ſtronger or weaker jelly. If we make a jelly, by boiling two calves feet in a gallon of water, for a certain time, and any given heat, it will jelly when expoſed to the cold air, the ſame as the lymph found on the different ſurfaces and cavities of the body. And, if we put four or ſix feet into the ſame quantity of water, boiled the ſame time, with the ſame degree of heat, the jelly will be proportionally altered from a weaker to a ſtronger conſiſtence: and hence I ſhould conceive the lymph in an animal to be liable to a ſimilar alteration; ſo that from its being a mere water, it may, by the addition or decompoſition of the nutritious particles, be made ſo thick or thin, as to produce a variety of diſorders, which may continually happen by the alterations of this important fluid from one extreme to the other.

But while the lymph retains its mediocrity, or is of ſuch a conſiſtence as to be ſufficiently impregnated with nutritious particles, and not ſo thick as to ſtagnate or to be obſtructed in the lymphatic veſſels, but will circulate freely throughout the body, I ſhould conſider this to be the moſt healthy medium by which the body can be preſerved and nouriſhed.

Since, then, the lymph is liable to ſuch a variety of alterations and changes, whilſt the animal is in health, it will not appear furſurpriſing that it ſhould be equally ſo when diſeaſed, and ſhould be the cauſe of many dreadful and fatal complaints, as it is the vehicle by which many diſorders are received, as well as cured.

Mr. Hewſon obſerves very judiciouſly, page 116, "That the properties of the " lymph exhaled upon ſurfaces and into " cavities, differ ſo widely in different cir" cumſtances; and as we find that pus is " often met with in ſuch cavities, without " ulceration, is it not probable that pus it" ſelf is merely that lymph, changed in " its properties by paſſing through inflamed " veſſels? The cavities of the pleura, pe" ricardium, &c. are ſometimes obſerved " to contain conſiderable quantities of pus, " without the leaſt mark of ulceration; in" ſtances of which I have ſeen: in one " patient I found three pints of pure pus in " the pericardium without any ulcer, either " on the membrane or on the heart. In " another, the cavity of the pleura of the " right ſide was diſtended with a pus, that " ſmelt more like whey than a putrid fluid,

" and the lungs were compreſſed into a " very ſmall compaſs, but there were no " appearance of ulcer or eroſion, either on " theſe organs, or on the pleura, but only " under the pus was a thin cruſt of coagulable lymph. In ſuch caſes, it is manifeſt, " the pus muſt have been formed from the " fluids; and as the exhalent veſſels at one " time appear to ſecrete a mere water, at " another coagulable lymph, and in a third " (when a little inflamed) they ſecrete that " lymph ſo viſcid, and change its properties ſo much, as to make it to coagulate inſtantly on being ſecreted; ſo in " like manner they may ſometimes, when " more inflamed, have the power of converting the lymph into pus: and according to the kind and degree of the inflammation, the pus may vary from the " bland, viſcid, and inodorous nature, to " that of the moſt thin and fœtid ſanies " found in phagedenic and cancerous " ulcers."

I am clearly of opinion, that pus is formed entirely from the lymph; for as we find that lymph partakes of the qualities of our food, when in health, it cannot be ſurpriſing that we find it undergoing different changes, when altered in itſelf; or impregnated with irritating, acrimonious, corroſive, malignant, putrid, or infectious matter. We have numberleſs inſtances that prove pus to be an alteration of the lymph; as, for inſtance, we ſee the clear, pellucid fluid, which moiſtens continually the eye when confined in the ductus adnaſum, changing its tranſparency in a few days and become pus, which is the caſe in a fiſtula lachrymalis. In a mere obſtruction of the noſe from cold, we find the fluid is changed from a clear and tranſparent one to a turbid ſimple pus. In the ſmall pox the puſtules at the beginning of the complaint are filled with a clear tranſparent fluid, which is the lymph; in a few days it becomes turbid, and forms what is commonly called ſimple pus or matter. This is only the firſt change, and is merely the lymph altered: but if this matter be not diſcharged from the body, whilſt it remains in this ſimple ſtate, it in a few days more changes from a mild to a malignant, infectious, and corroſive matter, which ſmells, becomes of a putrid tendency, and corrodes, eats holes in the fleſh, and if abſorbed, frequently proves fatal.

In a blow on the head, where there may not be any external appearance of injury, the lymphatic veſſels, from the dura mater of the inſide of the ſkull, connected with the perioſtæum* on the outſide, are ruptured from the accident, and diſcharge the lymph on the dura mater: the perſon ſo ſituated feels, perhaps, no inconvenience until the lymph changes and is abſorbed, when a fever comes on, with dangerous ſymptoms of miſchief, in the head, which increaſes, and death will, in all probability, be the conſequence, unleſs the putrid matter (which a few days before was a mild and healthy fluid) is timely diſcharged, by an early application of the trepan, which is very often the only probable chance of ſaving life.

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* When the lymphatic veſſels are torn or ſeparated the pericranium will alſo ſeparate from the bone, and ſuppurate, becauſe the part being deprived of the veſſels which conveyed the nutritious lymph to it are deſtroyed, and that part dies; this is replaced by the extenſion of the lymphatic ſyſtem and lymph of the neighbouring parts. Similar effects may be obſerved from the ſame cauſe in the perioſtæum, which covers the bones of any other part of the body. It is very immaterial whether the obſtruction be cauſed from a blow, injuring or deſtroying the veſſels themſelves, or whether the lymph be obſtructed by indurated or diſeaſed glands, ſuch as we often ſee in ſcrophulous and venereal diſorders, which produce theſe indurations of the glands, and are termed nodes, tophs, &c. A deſtruction of the ſurrounding parts and caries of the bone is the conſequence, which will extend as far as the lymph is obſtructed.

When the lymph is prevented from circulating through any part of the body, that part will die; and the putrefaction of the ſuppurated part, may contaminate and affect the other ſound parts in a ſimilar manner; particularly if the ſuppuration is diſcharged into any of the internal cavities. Thus it appears to be very immaterial, whether the obſtruction of the lymph be cauſed by an inflammation, produced by the lymph becoming ſo thick as not to circulate through the different membranes, and other parts of the body; or whether the inflammation and obſtruction be cauſed by a blow, or the abſorption of malignant or putrid matter, &c. the effects are in general the ſame, and are often attended with great danger, as we ſee every day in the pleuriſy, the peritoneal inflammation, blows on various parts of the body, as the head, kidneys, teſticles, &c. We frequently find the cavities, which contain theſe parts, filled with lymph that has been extravaſated and diſeaſed, from the lymphatic veſſels or membranes which inveſt theſe parts for their nutrition, being injured, and as ſoon as an inflammation takes place, let the cauſe be what it may, there is an end of the lymph circulating through theſe inflamed parts; for the heat that is immediately produced by inflammation, coagulates the lymph, ſo that it cannot circulate; and unleſs it can be diſcuſſed by reſolution, theſe obſtructed parts will ſoon ſuppurate, and the matter which is formed from their corruption or ſuppuration, being confined and mixed with the extravaſated and diſeaſed lymph, may be abſorbed and produce a ſuppuration of various parts of the body; as is frequently obſerved in the peritoneal inflammation, pleuriſy, child-bed fever, &c.

It therefore appears, that the whole of the danger ariſing from inflammation is cauſed by the obſtruction of the lymph, which becoming coagulated in the inflamed parts, the conſequence will be, that the obſtructed parts die from the want of this important fluid. Now to prevent the lymph from coagulating, it is evident that it muſt not be mixed with any thing that affords *coagulable matter*, as animal or vegetable food; but that the lymph muſt be kept, if poſſible, a mere water; ſo that by its thinneſs it may be able to paſs through the inflamed and obſtructed parts, without being ſubject to coagulation: and hence ariſes my idea of plentiful dilution in the firſt ſtate of inflammation, or where there is any preternatural heat; this being the greateſt chance of preventing the lymph from coagulating, and removing the obſtruction in the inflamed parts by reſolution; ſo that the lymph may be conveyed through the lymphatic veſſels, the ſame as it was previous to the inflammation, and prevent ſuppuration. And I am convinced that this opinion is well founded; for I have ſeen many inflammations reſolved, by giving plentifully toaſt and water, roaſted apples, &c. which has diſperſed the inflammation in two or three days.

In all inflammations, and in all parts of the body, I ſhould conceive this treatment judicious, as the intention is to remove the obſtruction and open the lymphatic veſſels by reſolution, before ſuppuration commences. But as there is no general rule without exception, ſo the preſent comes under that predicament; for although I recommend dilution, in the firſt ſtate of inflammation, in all parts of the body, if by this means, reſolution ſhould not have been accompliſhed, and the diſeaſe is in any of the internal parts, as in the head, thorax, or abdomen, and the inflammation is ſo far advanced as not to be diſperſed, and ſuppuration commences, it cannot be expected that diluting liquids can prevent the miſchief;

chief; but, on the contrary, it will be improper, becauſe it will keep the ruptured lymphatic veſſels continually diſcharging the fluid into their cavities, and from its being confined will corrupt and increaſe the danger. I ſhould therefore imagine, it would be better to keep the patient on a low diet, and endeavour, by that means, to get the matter that is diſcharged into the cavities, abſorbed as ſoon as poſſible *after ſuppuration*, whilſt the matter is *ſimple pus*, and before it becomes of ſuch an *acrimonious tendency as to inflame and ſuppurate the parts that abſorb it*. This treatment I ſhould conceive preferable when ſuppuration has taken place in any of the internal cavities, where the fluid, from being confined, becomes corrupt, and frequently deſtroys the perſon: but in all external inflammations and ſuppurations, where the matter can be diſcharged, diluting is certainly preferable, as it will keep the matter from entering the circulation.

There is yet another caſe which, I ſhould conceive, will not admit of dilution; namely, injuries of the head, where the lymphatic veſſels are ruptured. The giving quanties of liquids in this caſe would be not only improper, but injurious; becauſe, by filling the lymphatics, the fluid would be continually diſcharged from the ruptured veſſels into the cavity of the ſkull in ſuch quantities, as to cauſe a compreſſion of the cerebellum, which, in all probability, would be fatal; beſides, the confinement of ſuch a quantity of fluid, which will be continually changing to a ſtate of putrefaction, and would inevitably deſtroy the patient. Therefore, in all injuries of the head, where the ſkull is not fractured, and the ſymptoms will not juſtify the application of the trepan, I ſhould immediately put the patient on an extreme low diet, with a view to put the body in ſuch a ſtate, as to *abſorb the lymph that has been diſcharged, before it is become acrimonious, and by keeping the lymphatic veſſels empty, prevent any freſh accumulation of lymph*; and, by this means, the ruptured veſſels will not be diſtended, and in a few days may cloſe; the patient may afterwards eat and drink moderately, until he be perfectly recovered.

In all inflammations therefore, both internal and external, the firſt conſideration muſt be, to endeavour to diſperſe it by weak diluents, before the lymphatic veſſels are deſtroyed; and the ſame treatment is to be continued in all external parts, until they are properly ſuppurated to prevent abſorption, and diſcharge the acrimonious matter. We may then omit the fluids, and in a good conſtitution the wound will heal in a few days; but whenever ſuppuration takes place in any cavities where the lymph cannot be diſcharged, we muſt endeavour to get it abſorbed *before it becomes corrupted*, by keeping the lymphatic ſyſtem continually empty.

Independent of the change which the lymph undergoes in the diſorders which have been juſt enumerated, it is, moreover, liable to be rendered ſalt, ſour, bitter, acrid, corroſive, &c. which will produce a variety of complaints, ſuch as the jaundice, gout, rheumatiſm, eruptions, ſcurvy, leproſy, ſcrophula, lues venerea, cancer, &c. what the particular change may be that the lymph undergoes to produce many of theſe diſorders, I do not know; but it would certainly be of great benefit to ſociety if ſome perſon would carefully analize the diſcharge from theſe complaints, and, if poſſible, point out in what the acrimony conſiſts; we might then be able to apply a radical cure, and not be ſpectators of ſome of theſe unfortunate diſeaſes, without having it in our power to relieve the ſufferer.

It is not, therefore, to be wondered at that there ſhould have been ſuch a variety of opinions concerning this important fluid, ſince it evidently appears to be continually changing, and that there is almoſt an endleſs variety to be obſerved in it in health, and equally ſo when diſeaſed; ſo that at ſome time or other, it might have all thoſe appearances that it has been repreſented to have, and might juſtify the various and different opinions that have been advanced concerning it; but it is, *neverthele*ſ*s*, *equally* *evident that the uſe of it has never been known or aſcertained, as clearly appears by the writings of the moſt modern authors.*

That the uſe of it is for the nutrition of the body there cannot, I think, be a doubt, after what has been advanced; and particularly as we find the lymphatic glands, which are the organs through which this fluid is to paſs, are diſperſed for that purpoſe in every part of the body, even until they become inviſible, although they may be diſcovered by the microſcope; and in many diſeaſes they become conſpicuous to the naked eye, from their being enlarged and indurated, where they could not be perceived in health; as may be obſerved in examining the pleura, peritonæum, &c. of perſons who have died of conſumptions, lues venerea, dropſy, &c. Beſides, where there is any very important organ, whoſe office cannot be diſpenſed with, Nature has been particularly careful to place a gland for the ſeparation of this important fluid for the nutrition of ſuch organ; as, for inſtance, the renal glands are ſituated on the top of each of the kidneys and the epididymis,

mis, which is connected to the teſticles, in a ſimilar manner, as the renal glands are to the kidneys; that is, the lymphatic veſſels expand and unite, form lymphatic membranes, and inveſt theſe organs,* for the purpoſe of conveying nutrition to them.

The proſtate gland, in like manner, ſeparates the lymph from the blood, and affords nutrition for the urethra and penis; for I have ſeen, that when this gland has been obſtructed and diſeaſed, a mortification of the penis has been the conſequence. But I believe this gland to be yet more generally uſeful, and that it conveys lymph to the teſticle and ſcrotum; for when this gland is diſeaſed, inflammation, abſceſs, and ſometimes a ſuppuration of the ſcrotum and teſticle, is cauſed. Therefore, the deſtruction of the renal glands and epididymis, cauſe the deſtruction of the kidneys and teſticles; becauſe the paſſage for the lymph to them is denied; and although theſe parts may exiſt for a ſhort time, by the lymph that they may receive from the adjoining glands, yet the deſtruction of the kidneys and teſticles will ſoon be the conſequence; as we always find, on examining thoſe perſons who have died of diſorders of the kidneys or teſticles, that the renal glands and epididymis have been always found diſeaſed;* and an obſtruction of the proſtate gland, which ſo often happens in venereal complaints, and if not ſoon removed, is generally the forerunner of ſwellings, inflammation, and abſceſs, in the teſticles and ſcrotum, as well as of ſtrictures and ulcers in the neck of the bladder and urethra, and frequently, as I have juſt obſerved, of a mortification of the penis.

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* In a ſimilar manner, fruits are inveſted with external and internal membranes, to convey nutritious juices to them, as we ſee in oranges, nuts, &c. When theſe membranes are bruiſed, and the fluids obſtructed, they become putrid, the parts mortify, and the matter is equally infectious to them, as putrid matter is to an animal.

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* I believe there may be an exception to this, which is, that the formation of gravel or ſtones in the kidneys may ſometimes cauſe them to be diſeaſed, notwithſtanding the lymph may be regularly ſupplied; but in moſt other diſorders of the kidneys, the renal glands are found to be diſeaſed.

Nature has been ſo bountiful to us as to place ſuch a multitude of glands, that when ſome are injured or diſeaſed, others may ſeparate from the blood, lymph ſufficient to ſupply their loſs; we have proof of this every day, namely, that after diſeaſed glands have been extirpated from particular parts, the neighbouring glands have ſupplied their loſs; and we have many inſtances on record where the ſpleen, which is one of the largeſt lymphatic glands in the body, has been cut out, yet the animal will live; but in all theſe inſtances, the loſt or obſtructed glands are not ſo ſituated, that any important organ principally depends on them for the ſeparation of lymph for their nutrition, but only perform the office of generally diſtributing the lymph in common, and in conjunction with the other glands; and their loſs will not be of any great conſequence, ſo long as the other glands ſeparate lymph ſufficient for nutrition.

I believe the ſpleen does not ſecrete lymph for any particular organ, but that it extends generally, and conveys lymph to moſt of the organs contained in the abdomen; and when it is taken out, the remainder of the glands in the abdomen, which are extremely numerous, may, by an increaſed ſeparation of lymph, keep the animal in health; but when the glands of any part of the body, let it be wherever it may, become *totally obſtructed, ſo that no lymph can be conveyed, a mortification will be the conſequence, and from this cauſe alone will be produced, what we ſo often ſee, namely, that every part of the body, at particular times, will be ſubject to a partial or general mortification, even the bones not excepted*; and wherever this happens, the mortification will be more or leſs dangerous, according to the importance of the part to which the lymph cannot be conveyed. The mortification will extend until it meets with parts that are ſupplied with lymph, and it is then checked; but if the lymph is not ſecreted, or that the lymphatic ſyſtem is generally obſtructed, as is the caſe in the lues venerea, conſumptions, and old age, when far advanced; the mortification extends all over the body, and the animal is deſtroyed.

It appears then from what has been advanced, that the animal œconomy, or any part of it, is only preſerved in health or kept in exiſtence, ſo long as the fluids circulate through the organized parts that are placed for that important purpoſe, and that whenever any of theſe parts are obſtructed or diſeaſed, the conſequence produced will be more or leſs dangerous, according to the nature of the parts that are affected, and the cauſe of the obſtruction, &c.

And whilſt the machine remains free from diſeaſe, three things are abſolutely neceſſary to preſerve it in health, viz. 1ſt. That there muſt be healthy and nutritious chyle. 2d. That this chyle muſt be conveyed into the circulation, and circulate with the blood. 3d. That the lymph muſt be ſeparated from the blood, and muſt be conveyed to the moſt minute parts of the body; becauſe, when this fluid is obſtructed, the parts that are deprived of it, ſuppurate and die. *Therefore I infer, that the uſe of the lymph is for our nutrition, and, of courſe, it is the immediate cauſe of our exiſtence.*

CHAP. VII.

THE CONNECTION OF THE BRAIN WITH THE NERVES AND WITH THE LYMPHATIC SYSTEM.

THAT the brain is a gland has been generally believed by the firſt writers on anatomy. Hippocrates in particular, obſerves, that the brain is of a glandular ſtructure; and this aſſertion has been found true by many authors, who have preſented us with their obſervations and experiments on this ſubject.

Malpighi, whoſe experiments have always been conſidered, in general, as extremely accurate, ſays, that the brain is compoſed of an aggregate number of ſmall or minute glands, united or joined together ſo as to form one glandular body: but this formation is very different in the brain of ſome birds and fiſh, where the glands are not united or joined together, as they are in the human brain, but are diſtinct and ſeparate, and are compoſed of the extremities of minute arteries.

Ruyſch aſſerts, that the brain is vaſcular, and denies that it is glandular. This has been warmly conteſted by the adherents of each party, who have ſupported the opinions and doctrines of their teachers with great warmth in their controverſies; but, on examination, it will appear that they have each endeavoured to make diſtinctions where there are none, ſuch as glandular and vaſcular, which mean preciſely the ſame thing: glandular ſubſtances are demonſtrated by a variety of experiments, to be bodies compoſed of veſſels; which is all that is meant or underſtood by vaſcular ſubſtances.

That the brain is merely a gland cannot be doubted; for it reſembles, in many reſpects, the lymphatic glands of the other parts of the body. It is compoſed of blood veſſels; it has a fourth or a ſixth part of the blood in the whole body continually ſent to it, for which there could be no good reaſon given, unleſs there were to be a ſecretion made from it, in the ſame manner as from other glands. I ſhould therefore conſider the brain as a mere lymphatic gland, which is only connected with, and forms a part of the general ſyſtem; ſo that a gland ſituated in any other part, is a brain to ſuch part, and its office the ſame.

The ancients, and even many of the moderns, have aſſerted, that the brain was the ſeat of the ſoul, and ſuppoſed that all ſenſation originated in it: but this opinion is certainly founded in error; for modern experiments have very ſatisfactorily demonſtrated, that thoſe parts which have been ſuppoſed to poſſeſs the higheſt degree of ſenſibility, do, in fact, poſſeſs little or none; and the brain may certainly be conſidered to come under that predicament, for it poſſeſſes very little ſenſation; when I ſay very little, I ſhould wiſh to be underſtood that the brain has no more ſenſibility than the lymphatic glands of other parts of the body, which is very little; becauſe, we have many examples of this fact from various experiments, as alſo in venereal, ſcrophulous, and other ſwellings of the lymphatic glands, which are frequently attended with very little pain; and in this circumſtance, the brain appears to be affected in a ſimilar manner, and does not poſſeſs the power which it was ſuppoſed to do, of producing ſuch exquiſite ſenſibility.

We have inſtances, almoſt every day, where the brain from accidents has been conſiderably injured, and even parts of it ſuppurated, and yet the patient has not appeared to be in ſuch pain as it would be reaſonable to expect, if the brain really did poſſeſs a peculiar power of giving pain: neither have patients, during the cure of wounds of the brain, ſhewed ſymptoms that would induce one to believe that they ſuffered more, or even ſo much, as what they would have done from a wound of ſome other part. Heiſter relates ſeveral caſes where ſhots have paſſed through the ſubſtance of the brain, and have not proved fatal; and even in one inſtance, he mentions a ſhot that entered under the right eye, and paſſed out upwards through the brain and cranium, and the perſon got well: ſimilar accidents often happen, but do not prove fatal. Beſides, in many young animals the brain is a mere fluid; and in other animals, the brain has been found wholly wanting, yet they nevertheleſs have had the power of ſenſation; which is a ſufficient proof that ſenſation does not depend ſolely on the brain.

I cannot, therefore, admit that the brain is the organ of ſenſation; and I ſhall proceed to prove that all ſenſibility ariſes wholly from the cerebellum, and its continuation; and that the only real nerves, which convey ſenſation, ariſe entirely from it.

The cerebrum and cerebellum have, by moſt authors, been blended together; they have conſidered them as nearly the ſame bodies, and that all the nerves in the body originated from them. But this opinion is founded in error; for the cerebellum is materially different from the cerebrum: the cerebellum is ſituated in the hind part of the head, is much ſmaller than the cerebrum; it is ſeparated from it by the dura mater; it is evidently of a much firmer texture than the cerebrum, and has not thoſe turnings, windings, or circumvolutions, which the cerebrum has; but has a number of diſtinct fibres running parallel to each other, and appears to be compoſed of mere ſimple fibres, reſembling the nerves of the medulla ſpinalis. Beſides, it does not receive blood veſſels in the manner the cerebrum does; nor has it the leaſt appearance of a gland: it poſſeſſes ſo much ſenſibility, that many authors conſider a wound of it to be mortal.

Cheſelden, in his Anatomy, page 224, ſays, that wounds of the cerebellum and medulla oblongata cauſe ſudden death: there are alſo many inſtances of perſons who have inſtantly expired, by a ſlight prick from a pin or other ſharp inſtrument, that has accidently wounded the medulla ſpinalis; and we ſee daily many perſons inſtantly deſtroy animals, by giving them a blow on the hind part of the head, where the cerebellum is placed.

Dr. Ridley on the Brain, page 169, obſerves, that "'Tis true, that in ſeveral "creatures there are ſome nerves very much "depending on the cerebellum; as are they "which miniſter to the natural and vital "functions, viz. the par vagum and inter- "coſtal pairs; and therefore Dr. Willis, "who is in this, as in many other of "his diſcoveries, very fortunate and "highly commendable, made a very good "gueſs when he brought theſe faculties into "ſubjection to that part; inaſmuch, as by "ſeveral others, as well as my own expe- "rience, upon living bodies, we find, *that* "*notwithſtanding moſt part of the brain be* "*pared off with a razor, yea, even after* "*the medulla oblongata be divided betwixt* "*the cerebrum and cerebellum, and taken* "*wholly out of the cranium, the heart* "*will beat, when, at the ſame time, if the* "*cerebellum itſelf be but cut in pieces, though* "*all the reſt of the brain be kept entire, the* "*creature expires preſently.* Yea, I have "ſeen reſpiration (which only in part de- "pends on the cerebellum) *totally to ceaſe* "*upon only a ſudden violent compreſſion of*

" *that part by a blow, and, after its being*
" *wounded, the heart to ceaſe beating im-*
" *mediately.*"

I conſider theſe experiments as perfectly concluſive proofs, that ſenſation ariſes excluſively from the cerebellum and medulla ſpinalis, eſpecially as Dr. Ridley relates, a few pages farther on, which I ſhall notice in its place, ſeveral inſtances of animals that have had no brain, had very little cerebellum, but have had the medulla ſpinalis enlarged, which prove it to be ſufficient to convey ſenſation independent of the brain; and therefore it is certain that ſenſation does ariſe from the cerebellum and medulla ſpinalis: but it is very probable that the medulla ſpinalis alone, or being enlarged, might perform all the functions that are neceſſary for animal exiſtence, provided that there were a ſufficient number of lymphatic glands connected with it, to ſeparate as much lymph as would preſerve it in health, otherwiſe it could not perform its functions; and the ſame may be obſerved of all other parts; indeed, I think the following caſes will put this matter beyond all doubt.

Dr. Ridley ſays, page 176, "But now "to return where we left off; in ſome "creatures it is very plain that nature hath "extended this imperial reſidence of the "*ſoul beyond* the *cerebellum*, even as far as "the *ſpinalis medulla*, having not only put "this laſt motion, but that of pulſation too, "under the juriſdiction of that elongation "of the brain; as appears in the famous "experiment of the induſtrious Caldeſi "upon the tortoiſe, which after the head "was cut off, lived and carried its ſhell "about the ſpace of ſix months." And he farther relates the following curious caſes, which demonſtrates, that the animal functions may be performed without either cerebrum or cerebellum, and that the medulla ſpinalis alone will perform theſe offices: he ſays, page 178, As a proof of animals performing their functions without cerebrum or cerebellum; "of the firſt is an "inſtance of the learned Wepfer, in a child "living ſixteen hours after it was born, and

“ diſcharging all the duties of nature that “ one of its age was capable of; and by “ the by (which all the patrons of a nutri“ tious juice by the nerves may do well to “ take notice of) of a very ſtrong and “ good habit of body, whoſe brain, after “ death, was found to be only an heap of “ watery bladders or hydatides, except a “ ſmall part at the bottom of the ſkull, “ lying in a ſinus, made in the wedge-like “ bone, where the pituitary gland is com“ monly found, conſiſting only of three “ medullary bodies, two of which being “ each of the bigneſs of a kidney bean, and “ the third behind them of a pea only, from “ which indeed there did proceed ſome, but “ very inconſiderable nerves or nervous “ fibrils; but ſuch as none can judge of a “ due proportion requiſite to ſatisfy the “ exigencies of the common natural and “ vital functions.” He then obſerves, that “ The truth of which is ſtill more plain, and “ without exception in another inſtance in “ the Miſcell. Med. Phyſic. Gallic. of a “ child living five days after it was born, “ whoſe head had nothing but water con-

" tained within the incloſures of the dura and
" pia mater, without the leaſt footſteps of
" any medullary part at all. Parallel to
" which two laſt inſtances, I had communi-
" cated to me by that curious anatomiſt and
" learned perſon, Dr. Tyſon, in a child
" born alive with no more brain in the
" ſkull than what might lie in a filbert ſhell,
" *the medulla ſpinalis being much larger than*
" *ordinary*, as though part of the abſent
" brain had been ſqueezed down thither.

" Of the laſt, viz. where the natural
" conformation hath been depraved, there
" is extant an inſtance in two ſeveral places
" of the Miſcell. Curioſ. in a fat ox, in
" which, whilſt living, there were obſerved
" but very little ſigns of any ſuch thing,
" *whoſe brain was nevertheleſs after death*
" *found wholly petrified.*"

He then very properly concludes from theſe curious caſes, that " From all theſe
" it is manifeſt, the ſenſitive faculty is able
" to anſwer its internal or external impreſ-
" ſions, by one part as well as another;
" and

" and that the medullary ſyſtem of the *ſpina-*
" *lis medulla* may become as *adequate a ſen-*
" *ſory*, in relation to the aforeſaid func-
" tions, ſometimes as either *cerebrum* or
" *cerebellum*."

The Abbé Fontana has demonſtrated, that certain animals will continue to live days, weeks, nay even months, after the brain has been taken out, or even when the head has been removed. This experiment has been frequently repeated on various animals, ſo that there can be no doubt of the fact; and although the animals were thus mutilated, they nevertheleſs continued to have the power of ſenſation, ſo that they appeared to feel, and judge, and perform the ſame motions that they previouſly did; which proves that the *medulla ſpinalis alone* is ſufficient to perform all the animal functions, independent of the *cerebrum* or *cerebellum*; and we have many other examples of children that have been well formed, and have had the appearance of ſtrong and healthy conſtitutions, who have not had any brain. Monro, on the Nervous Syſtem, ſays, that

"In children delivered at the full time, "plump and well formed in their trunk and "limbs, I have obſerved the ſubſtance "which ſupplied the place of the brain not "more bulky than a ſmall nut, and inſtead "of containing a white medullary ſub- "ſtance, it was of a red colour, reſembling "a clot of blood, *and ſmall chords occupy- "ing the place of the optic nerves, were "likewiſe of a red colour; yet the ſpinal "marrow, and all the nerves from it, had "the ordinary ſize and appearance.*

"In a monſtrous kitten with two bodies, "and appearance of one head, I found the "ſpinal marrow of one of the bodies con- "nected with a brain and cerebellum of "the common ſhape and ſize, *but the ſpi- "nal marrow of the other body, though "equally large, had only a ſmall button of "medullary ſubſtance at its upper end, with- "out a ſuitable brain or cerebellum.*"

There are other inſtances ſimilar to the above, which might be adduced as proofs of animals poſſeſſing all their faculties without having any brain. This ſhews how viſionary is the doctrine of phyſiognomiſts, who pretend to meaſure a man's wiſdom by the ſhape and ſize of his brain and ſkull; and ſhews how very erroneous it muſt be to conſider the brain as the organ of ſenſation or ſeat of the ſoul; and that we cannot attribute to man the ſuperior reaſoning faculties which he poſſeſſes over all other animals, on a ſuppoſition or preſumption of his brain being larger in proportion to theirs. If it were really true, that our reaſon depended on the ſize of our brain, we muſt poſſeſs the greateſt degree of reaſon as ſoon as we come into the world; the brain, like all other lymphatic glands of the body, being conſiderably larger in proportion at the time of birth, than at any period ever after; and when old age advances on us, it diminiſhes in proportion to the lymphatic glands of the other parts of the body, ſo that the faculties only become impaired in the ſame proportion as all other parts; that is, the uſual quantity of lymph, ſeparated by the brain and other glands, is leſſened by their waſting, or by obſtruction, and cauſes a diminution of the nerves, and, of courſe, our faculties.

I certainly conceive, that if other glands were connected to the nerves, inſtead of the brain, and that they were capable to ſeparate as much lymph as the brain does, that our ſenſations would be equally perfect, and that it would be very immaterial whether there was, or was not, any brain; but in ſome animals that have large brains, to which a fourth or a ſixth part of the blood in the body is continually carried, the ſeparation from it muſt be ſo great, as not to be diſpenſed with.

It evidently appears, then, from what has been advanced, that ſenſation ariſes from the cerebellum and medulla ſpinalis; and that its continuations alone form the nerves, and not the cerebrum, which is only connected to them in the ſame general manner that the lymphatic veſſels are with the various parts of the body for their nutrition, performing the ſame office as other lymphatic glands and veſſels. I would, however,

ever, diſtinguiſh the brain, by conſidering it the *fountain head* of the *lymphatic ſyſtem.*

Now, if it be admitted that the brain is a lymphatic gland, it muſt neceſſarily follow, *that the continuations of the brain are not nerves*, as all authors, both ancient and modern, even thoſe of the preſent day, aſſert, and is now the general and univerſally received opinion. It will be certainly fair to infer from analogy, that as all other glands throughout the body have excretory ducts, ſo the continuations of the brain are not nerves but lymphatic veſſels, appropriated to convey lymph from the brain, in a ſimilar manner, to the lymphatic veſſels originating from other glands; that thoſe parts iſſuing from the brain are its excretory ducts, and that they unite themſelves to the *real nerves* in a ſimilar manner to what the lymphatic veſſels do in all other parts of the body. Hence it will appear, that the nerves have been erroneouſly conſidered as formed by two ſubſtances very different and diſtinct from each other; namely, from the union or conjunction of the cerebrum and cerebellum, their continuations, and ganglions; and therefore it muſt follow, that theſe ſubſtances being ſo very different, their continuations, which are ſuppoſed to form the nerves, muſt be ſo likewiſe; and that this is the fact, cannot, I think, be doubted.

Galen *(de uſu partium)* has made a diſtinction betwixt the continuations of the cerebrum and cerebellum; for he ſays, that the cerebrum is ſofter than the cerebellum, becauſe it is the origin of the ſoft nerves, as the cerebellum is of the hard; and that the nerves which iſſue from the medulla ſpinalis, are harder than thoſe which originate from the cerebrum; and hence many of the ancients have diſtinguiſhed the nerves into two claſſes, viz. under the denomination of hard and ſoft nerves, and attributed different offices to them; as for inſtance, they conſidered the hard nerves, which aroſe from the cerebellum and medulla ſpinalis, as the organs by means of which all ſenſation is conveyed; and the ſoft nerves which originate from the brain, they conſidered as the organs of motion; and beſides, if the continuation of the brain were nerves, there could be no good reaſon aſſigned for the firſt and ſecond pair of the ſpinal nerves being ſent to the head for the continuations of the brain, if nerves could give ſenſation to all thoſe parts.

From the great difference there is to be obſerved in the continuations of the cerebrum and cerebellum, and the different effects produced by injuries of theſe parts, authors have aſſigned peculiar offices to each, ſuch as their attributing to the continuations of the cerebrum, the power of all *voluntary motions*, and to thoſe of the cerebellum, *involuntary motions*.

Others again have aſſerted, that the nerves are compoſed of tubes conveying a fluid, by the means of which they performed ſenſation; and this opinion has been ſupported by ſome of the moſt eminent anatomiſts. Others, equally eminent and celebrated, have poſitively denied the very exiſtence of ſuch fluid, and aſſert the nerves to be firm ſolid chords, and perform motion and ſenſation by vibrations, and hence, There is no queſtion in phyſiology involved in ſuch obſcurity, and in ſo many difficulties, as to explain in what manner the *nerves do* perform the functions of *motion* and *ſenſation*; the diſpute has hitherto been a conſtant ſource of hypotheſis, without much ſatisfactory information.

The nerves certainly cannot perform their functions by vibrations or tremulous motions, as many have aſſerted; for if they did, they muſt be firm, ſolid chords, elaſtic, and faſtened at their extremities to render them tenſe, for the purpoſe of conveying vibrations or tremulous motion. Now the nerves, on the contrary, are *ſoft* and *inelaſtic*, as appears when they are divided, for they neither ſhorten or contract; they are not faſtened at their extremities, and have no tenſion, and therefore cannot convey motion or ſenſation by vibrations, or tremulous motions.

That the lymph is the medium, eſſentially neceſſary, by which the nerves perform their functions, appears evident in many inſtances;

ſtances; in animals that have been killed, the contraction of the muſcles continues as long as the nerves are moiſt, and this contraction will diminiſh as the lymph is exhauſted. In a common cold, producing an obſtruction of the lymph, ſo that it cannot paſs regularly through the obſtructed glands into the nerves, hence *hoarſeneſs, loſs of ſpeech, of hearing, and ſmelling*, may be the conſequence; all of which will return as ſoon as the obſtruction is removed; and this, if not ſoon accompliſhed, may be attended with ſerious conſequences; ſuch as the *irrecoverable loſs of thoſe faculties*. Thus there are examples of ſingers who have had powerful voices entirely deſtroyed from a common cold, or inflammation of the throat, which cauſed the nerves to ſuppurate, by an obſtruction of the lymph. This is alſo clearly demonſtrated to be the fact in conſumptions, ſcrophula, lues venerea, and fevers, where the glands become obſtructed, and the faculties depending on them loſt.

Hence it appears, that the lymph is eſſentially and abſolutely neceſſary for the *nutri-*

tion and preſervation of the *nerves* in *health*; as they can only perform their *functions perfectly* whilſt they remain ſo: yet, if this be admitted, I am apprehenſive that we ſhall ſtill be at a loſs to ſhew in what conſiſts the peculiar quality or eſſence, by which the *nerves*, *whilſt in health*, are ſuſceptible of ſuch impreſſions, as we know they receive from the application of different ſubſtances to them; neither can we demonſtrate how they perform motion and ſenſation.

It is a certain fact, that if part of a nerve be cut out of an animal juſt dead, and placed in the receiver of an air-pump, the lymph will exude from it, and will coagulate in a ſimilar manner to the lymph found in other parts of the body; whence it is evident that the lymph iſſued from the lymphatics that were connected with the nerve: and if we cut a nerve tranſverſely that has been diſtended with air and dried, there will appear a number of pores, and, what many authors have aſſerted to be, cavities to convey the nervous fluid. Injections from the blood veſſels have paſſed through the lymphatic veſſels, and have appeared to paſs into the ſubſtance of a nerve, which has induced authors to aſſert, that they had found the *cavities* of nerves which conveyed the fluid; but on a careful examination of the injected nerve with the microſcope, the *lymphatics only* were injected, and not the ſubſtance of the nerves, which appeared like ſo many diſtinct and ſeparate fibres or threads, without any viſible appearance of cavities.

Profeſſor Monro, as quoted in Cheſelden's Anatomy, page 225, ſays, that "From the medullary part of the cerebrum, "cerebellum, and medulla ſpinalis, a vaſt "number of ſmall medullary white fibres "are ſent out, which, at their firſt egreſs, "ſeem eaſily to ſeparate, but as they paſs "forward, are ſomewhat more, but ſtill "looſely connected, by the coat which "they obtain from the pia mater, and at "laſt piercing the dura, are ſtraightly braced "by that membrane, which covers them "in their progreſs, whence they become "white firm ſtrong chords, and are ſo well "known by the name of nerves. To theſe "coats an infinite number of veſſels, both

" arteries and veins, are diſtributed; ſo
" that after a nice lucky injection the
" whole chord is tinged with the colour of
" the injected liquor; but when the fibrils
" are examined, with the beſt microſcope,
" they appear like ſo many ſmall and diſ-
" tinct threads running parallel, without
" any cavity obſervable in them; though
" ſome incautious obſervers, miſtaking the
" cut orifices of the arterious and venous
" veſſels, juſt mentioned, for nervous tubes,
" have affirmed their cavities to be viſible."

Now, if we admit that the brain is a lymphatic gland, and its continuations are *lymphatic veſſels* and not *nerves*, as they have been improperly termed, we ſhall be able to reconcile the opinions of thoſe authors who have aſſerted, that the *nerves conveyed a fluid, with the opinion of thoſe who deny it*; the former, inſtead of injecting nerves as they imagined, (although juſtified in this opinion, inaſmuch as all continuations of the brain were ſuppoſed to be nerves) *did, in fact, only inject the lymphatics iſſuing from the brain*, and the injections did not paſs into the ſubſtance of the nerves ariſing from the cerebellum and medulla ſpinalis, the only true nerves: and hence originated the error.

There are certain glands placed in ſeveral parts of the body, and commonly diſtinguiſhed by the name of *ganglions*; they have been conſidered as giving egreſs to nerves, in a ſimilar manner as the nerves were ſuppoſed to iſſue from the brain, and to extend the nerves, and convey ſenſation to the various parts to which they were connected. But this ſuppoſed office has been improperly attributed to them, becauſe they are found to poſſeſs very little ſenſibility, and are diſtributed to many parts where there is not, nor is there any neceſſity there ſhould be, any exquiſite ſenſation conveyed to them.

Profeſſor Monro, ſpeaking of the conjunction of the nerves with the ganglions, (ſee Cheſelden's Anatomy, page 227.) ſays, that "In ſome parts where there are ſuch "conjunctions, the bulk of the nerves

" ſeems much increaſed; and theſe knotty
" oval bodies, called by Fallopius corpora
" olivaria, and generally now named gang-
" lions, are formed. The coats of theſe
" knots are ſtronger, thicker, and more
" muſcular than the whole nerves which
" paſs into them would ſeem to conſtitute,
" whilſt the nervous fibrils paſs through
" without any great alteration or change. I
" do not think any author has yet made a
" probable conjecture of the uſe or deſign
" of theſe ganglions, whether they imagine
" them corcula expellentia, reſervoirs, or
" elaboratories; neither can I give an ac-
" count of their uſe the leaſt ſatisfactory to
" myſelf." And Cheſelden, page 247 of his Anatomy, ſays, that the nerves " All
" paſs in as direct courſes to the places they
" ſerve, as is poſſible, never ſeparating nor
" joining with one another but at very acute
" angles, unleſs where they unite in thoſe
" knots which are called ganglions, the uſe
" of which I do not pretend to know; they
" make what appears to be a communica-
" tion of moſt of the nerves on the ſame

" ſide, but never join nerves on oppoſite
" ſides."

Now I ſhould conſider the office of theſe parts to be very important, and their uſe to be the ſame with that of the brain; their texture is ſimilar; they are formed by convoluted arteries; they have excretory ducts, which have been conſidered nerves, and are united to the ſpinal nerves in the ſame manner as the brain is; as for inſtance, as ſoon as a new nerve iſſues out of the medulla ſpinalis, it immediately goes to theſe ganglions or glands; the veſſels ariſing from theſe knots immediately embrace the nerves, which grow larger as ſoon as they are united; they then expand together to great minuteneſs, forming a beautiful net-work of veſſels, which, as they become more and more minute, are loſt to the eye.

The lymphatics from theſe ganglions penetrate and inveſt the nerves, in a ſimilar manner to what the lymphatic veſſels to all other parts of the body do, for their nutrition, and their office is to convey lymph to the nerves, as they only form a part of that general and univerſal ſyſtem, which is extended to every part of the body.

That ganglions are glands, and ſecrete lymph for the nutrition of the nerves to which they are connected, is farther confirmed in many diſeaſes, ſuch as ſcrophula, lues venerea, fevers, &c. for when theſe glands become indurated, inflamed, or ſuppurated, the nerve connected with them partakes of the evil, and muſt alſo be ſubject to inflame and ſuppurate: and hence, the cauſe of partial palſies, or loſs of our ſenſes; ſuch as the *ſight*, *ſmell*, *hearing*, &c. and hence, alſo, it evidently appears how vain it muſt be to expect a cure of a complaint, ariſing from ſuch a misfortune, as it muſt, from the nature of things, be abſolutely impoſſible, unleſs we poſſeſs the power of replacing the parts deſtroyed.

The old writers were right in conſidering the brain as the origin of motion, although they were entirely ignorant of the manner of its operation; for it is a fact, that the nerves can only poſſeſs a power of motion and conſequent ſenſation, ſo long as the brain and ganglions regularly convey lymph to them for their nutrition; becauſe when they are deprived of this fluid, the nerves loſe their power of conveying either *ſenſe* or *motion*; and theſe effects may be either partial or univerſal, according to the degree or nature of the cauſe which produced them: as for inſtance, if we cut or tie a branch of a nerve which ariſes from the medulla ſpinalis, a convulſion and imperfect ſenſation will be the conſequence. If we tie or cut the nerve at its trunk, ſo that no collateral branches eſcape the effect of the ligature, the part ſuch nerve goes to, loſes all ſenſation; *but yet the muſcles retain their tonic quality*, *and are nouriſhed. This*, *in general*, *is the effect produced by an injury of the ſpinal nerves when the body is in health.* But let us reverſe this caſe, and ſuppoſe the nerves uninjured, and that we obſtruct the lymph from paſſing into them, by injuring the brain or lymphatic glands, which, according to the nature of the obſtruction, will produce the

ſame

ſame effect as a ligature. We ſhall then find, that as the partial obſtruction of the lymph, to any branch of a nerve, produces convulſion or imperfect ſenſation; *ſo when the whole of the lymph is obſtructed, the part not only loſes its ſenſation, but, what is of more ſerious conſequence, it ſuppurates and dies.* Hence paralitic complaints are produced by two very different cauſes; namely, either from an injury of the nerves themſelves, or from an alteration or obſtruction of the lymph, which may produce irritations, convulſions, inflammation, and ſuppuration, as is frequently ſeen in fevers, rheumatiſm, gout, &c. and theſe effects will be more or leſs dangerous, according to the degree of the obſtruction and alteration that has taken place in the lymph, and according to the nature and importance of the office of the organs that are deprived of it; and this may be either confined to a particular part, or it may extend to every part of the body; as appears in many diſeaſes, and particularly in thoſe termed nervous, where all the faculties are impaired, in proportion to the mechanical cauſe which gave riſe to the complaint.

If, for inſtance, the glands which ſeparate lymph for the nutrition of the nerves of ſeeing, ſmelling, hearing, taſting, &c. become obſtructed, or ſuppurate, either from conſumptions, ſcrophula, lues venerea, blows, or fevers, or from any other cauſe, the conſequence, as I have already obſerved, will be, that the nerves connected with theſe glands will alſo ſuppurate, and the patient will be deprived of ſuch ſenſe or faculty: and this is not peculiar to the nerves, for a deprivation of the lymph will cauſe a waſting of the parts, in proportion to ſuch deprivation; and a total obſtruction will cauſe a mortification; for every part of the body is liable to be affected in the ſame manner: and hence it appears, that a paralitic complaint cauſed by a defect in the lymph, in many inſtances, muſt be attended with greater danger than one cauſed by an injury of the nerves themſelves, unleſs the nerves injured belong to ſome vital organ; as in injuries of the beginning of the medulla ſpinalis, which cauſe the lungs and heart to ceaſe their motions, and muſt prove fatal: but with reſpect to the nerves that are not connected with vital organs, and are ſuch that the animal œconomy may go on without their aſſiſtance, an injury of them may not be attended with immediate danger; nay, even if the trunk of the nerve which gives motion to the part be injured, ſo that none of the collateral branches eſcape, the utmoſt conſequence that can happen will be a loſs of the uſe of the part, becauſe the lymph in this caſe not being altered or impeded, the part, although deprived of ſenſe and motion, is nevertheleſs nouriſhed, and the muſcles retain their tonic quality.

If the ſciatic nerve of living frogs be cut, (ſee Monro's Obſervations on the Nervous Syſtem) and the animals preſerved for upwards of a year afterwards; in ſome it will be found *united*; yet, nevertheleſs, in none of theſe animals will the limb recover its power of *ſenſation* or *motion*; but what is very *remarkable*, *the nerves that have been divided will be equally as large as thoſe in the ſound limb*: hence it appears, that although the functions of the nerves may be loſt, yet, if the *lymph* be conveyed to them, they will increaſe, and be nouriſhed the ſame as if they had not been deprived of their functions by injuries.

Thus perſons may have a convulſion or palſy in many parts of the body, by an injury of the nerves, which may continue through life; as we ſee often in perſons who have a palſy of particular parts, ſuch as in one arm, leg, or ſide, &c. and, in ſome caſes, both ſenſation and motion may be entirely loſt, and yet, if lymph be ſupplied, it may not prove fatal.

I have ſeen caſes of the curvature of the ſpine, ariſing from an injury of the medulla ſpinalis, or of the particular glands connected with it, by a hurt or blow: and I have alſo ſeen this complaint cauſed by a weakly, ſtrumous, or conſumptive habit of body; but there may be obſerved very different ſymptoms, by which the cauſe of the complaint may be eaſily and readily diſtinguiſhed; for the diſeaſe, in the firſt inſtance, frequently happens to ſtrong healthy children, in whom there has not been, previous to the appearance of the diſorder, the leaſt ſymptom of ſcrophula or conſumption: and I have known perſons in this ſituation for years, who eat and drank hearty, the body was nouriſhed, and the muſcles retained their tonic quality, although the urine and fæces were voided without the patient being ſenſible of it; and all the parts below the injury had loſt both ſenſe and motion, ſo that if the fleſh was pinched or pricked, there was not the leaſt motion or ſenſation produced or felt.

But in the curvature of the ſpine that is cauſed by ſcrophulous or conſumptive habit, the lymphatic glands in moſt parts of the body are diſeaſed, ſo that the lymph is obſtructed, and the fleſh in this caſe becomes flabby, and incapable of being put into a tonic ſtate, as in the preceding caſe; and the whole of the body waſtes and dies, in proportion as the diſeaſe advances; white ſwellings and caries of the bones, in all other parts of the body, may be produced by the ſame cauſe.

It was the opinion of the ancients, that humours were diſcharged from the brain by the eyes, noſe, mouth, ears, &c. and this opinion appears to be well founded; for I have ſeen perſons who have repeatedly made the ſmoke of tobacco paſs from the mouth in full ſtreams, out of the eyes, noſe, and ears, by the connection of the lymphatics; theſe perſons were in perfect health, and had no defect in any of their faculties: and it is a certain fact, that there is not only a paſſage from the brain to any one part of an animal, but alſo to and from every part throughout the whole body. By means of ſuch paſſages, many of the moſt fatal diſeaſes are received, independent of the circulation; as for example, infectious or putrid air may paſs through the *proceſſus mamillares** into the ventricles of the brain;

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* *The proceſſus mamillares* is conſidered the firſt pair of nerves iſſuing from the encephalon, and are ſuppoſed to poſſeſs *no cavities*; but this is erroneous; for fumes readily paſs through them into the ventricles of the brain, and may be diſtributed to every part of the body, by the univerſal connection of the lymphatic ſyſtem. Super-

from thence into its excretory ducts, and may be carried all over the body by the *par vagum*, and hence ariſe the excruciating pains, rheumatiſm, lumbago, &c. of which perſons, who have received infection in this manner, frequently complain, and which, in many inſtances, cauſe inſtantaneous death.

It alſo farther appears, that when the body is exhauſted, and theſe veſſels are empty, that putrid fluids may be abſorbed from the uterus, inteſtines, and ſtomach, as well as from every other part; and conveyed to the cerebellum and cerebrum; and hence it alſo appears, why head-ach, and affection of our faculties or phrenites, are ſo commonly

Superflous fluids alſo collected in them, may be diſcharged by the ſame paſſage through the noſe. The proceſſus mamillares of brutes are frequently found diſtended with lymph, and their cavities remarkably large, ſo as to be conſpicuous to the eye; and hence, the cauſe of the acute ſenſe of ſmelling that many animals poſſeſs, the paſſage being ſo large, as to permit a great quantity of air, impregnated with the effluvia, to paſs to the nerves.

the conſequence of putrid or infectious fluids being confined in any part of the body.

I am aware it may be urged, that the lymphatic veſſels are thin and tranſparent, and that the continuations of the brain and ganglions are thick and opaque, and that, therefore, they cannot be conſidered as the ſame kind of veſſels: to this I anſwer, that opacity ariſes merely from increaſe; for if we take a leaf of thin paper the light will paſs through it, and it will be tranſparent; but every time we add an additional leaf it becomes more and more obſcure, till at laſt it becomes perfectly opaque. It is the opinion of Sir Iſaac Newton, that the capillamenta of nerves, when viewed ſingly, are pellucid: but when compoſed of many capillamenta, they appear white and opaque. This is evidently the fact in other parts of the body that are not nerves; as, for inſtance, the arteries are thick and opaque in their trunks, which ariſe from the heart; as they are traced towards the extremities, the ſame veſſels become proportionally thin and tranſparent, and the cornea, or what is termed by ſome, the tunica ſclerotis, which is the membrane that contains the humours of the eyes, has its fore-part remarkably thin, clear, and tranſparent; but the hind or poſterior part is thick, white, and opaque, although the ſame membrane, and therefore opacity ariſes merely from increaſe; and hence it appears, that the opacity of the continuations of the brain cannot be conſidered as an objection to their being lymphatic veſſels, as it is cauſed entirely by a number being joined or united together: and this could not poſſibly be avoided, for if we were to ſuppoſe them diſtinct and ſeparate veſſels iſſuing from the brain, they might not be able to get out of the ſkull; and, beſides, the ſmallneſs of the neck would not afford them a paſſage to the parts for which they were intended, without being continually ſubject to be injured; but from a number being joined together, they can more conveniently paſs through the neck, without being interrupted by the œſophagus or aſperia arteria.

From what has been advanced, I conclude that the cerebellum, and its continuation, the medulla ſpinalis, are the organs of all *ſenſation* and *motion*; and that the *brain is merely a lymphatic gland*, and its continuations *lymphatic veſſels*, forming part of the lymphatic ſyſtem.

CHAP. VIII.

CONCLUSION.

I HAVE endeavoured, in the preceding obſervations, to avoid as much as poſſible, profeſſional terms, and to explain my meaning in as plain and familiar a manner, as the nature of the ſubject would admit; but in caſe it ſhould appear that I have expreſſed myſelf in any part ſo as not to be clearly underſtood, I ſhall beg leave to take a ſhort review of ſome few of the principal points that I ſhould wiſh to impreſs on the reader's attention; theſe are:

That the lymphatic ſyſtem does not ariſe from cavities and ſurfaces, nor does it terminate in the thoracic duct, as is the general, received opinion; but that it originates from the heart, and terminates in all ſurfaces and cavities, with which they themſelves are formed; by an extenſion of the lymphatic ſyſtem.

That the lymphatics and lacteals are ſeparate and diſtinct ſyſtems; the lacteals terminating in the thoracic duct, conveying chyle *into* the blood; whereas the lymphatics ſeparate lymph *from* the blood, and diſtribute it to every part of the body.

That the lymphatic glands are for the ſeparation of the lymph from the blood; that they are ſimply compoſed of arteries convoluted, which form the gland; that the ſame veſſels, as ſoon as they come out of the gland, divide into innumerable anaſtomoſing branches, and form a ſyſtem of lymphatic veſſels; and that there is, by means of this organization, a direct natural paſſage or communication *from and into the blood veſſels in every part of the body.*

That tranſudation does not take place either in the living or dead body, but that every thing we obſerve in it, is the operation and effect of parts appointed to produce them, and performed by organization alone.

That the blood is a compound fluid, peculiarly adapted to let certain parts of it paſs through the glands; and the glands are ſo formed, as to prevent the red globules of blood, neceſſary to be confined in the blood veſſels, from paſſing through them.

That abſorption is not performed by the red veins but by the lymphatics, when from exerciſe, fatigue, or inanition, they become empty; and, in that ſtate, they conſtitute a ſyſtem of abſorbents, conveying fluids into the blood from every part of the body.

That ligatures on the blood veſſels are not the cauſe of the lymphatic veſſels being filled with lymph, by obſtructing its paſſage into the thoracic duct, but that the lymph paſſes through the lymphatic glands into the lymphatic veſſels.

That as ſoon as the lacteals are filled with chyle, they appear white; for when there has been a quantity of chyle conveyed into the blood, ſufficient to cauſe a ſeparation of the lymph from the blood, the *lacteals* are to be ſeen conveying *white chyle*, and the *lymphatics* filled with *clear tranſparent lymph*; and when all the chyle is conveyed into the blood, then the lymphatics only are to be ſeen, and not the lacteals.

That the lymph, deprived of its nutritious particles, is a mere water; that it only derives its different degrees of conſiſtence from its being impregnated with the quality and quantity of our food, whereby it is conſtantly liable to change; and equally ſo when diſeaſed: from theſe circumſtances, it may have all the appearances which different authors have attributed to it; that it is univerſally extended throughout the body, and that it is the immediate cauſe of nutrition.

That what is commonly called *ſimple pus*, is the *lymph altered*; and that the diſcharge from ulcers ariſing from various complaints, is the *lymph diſeaſed*, ſo that it partakes of the nature of the diſorder, and is *changed* from the *mildeſt*, *ſimple*, *inoffenſive* fluid, into the moſt *corroſive*, *malignant*, or *putrid* one, which deſtroys, in many inſtances, every thing it touches.

That the brain, and its continuations, are *not nerves*, as has always been the generally received opinion, but that it is merely a *lymphatic gland*; and its continuations not nerves, but lymphatic veſſels. That it does not poſſeſs any greater degree of *ſenſation* than any other gland in the body; is not the ſeat of ſenſation, and only forms a part of the lymphatic ſyſtem.

That *ſenſation* wholly reſides in the *cerebellum* and *medulla ſpinalis*; and that *no nerves exiſt* but what originate from them: that the brain and its excretory ducts are only united to them, to ſupply lymph for their nutrition, in the ſame manner as other parts are ſupplied by their contiguous lymphatic glands and inveſting veſſels throughout the animal œconomy.

Before I conclude theſe obſervations, I ſhould wiſh to ſay, that as I have quoted paſſages from the works of ſeveral Gentlemen, deſervedly held in the higheſt eſtimation, ſome of which are ſo evidently contradictory, that they muſt appear very unſatisfactory to thoſe who will conſider the nature of the ſubject; my only view in pointing them out has been to ſhew by them, that the preſent opinion of this important ſyſtem cannot be founded in truth; and ſeveral paſſages that I have noticed have been ſuch, that even the authors of them have acknowledged, they contained difficulties impoſſible to explain, or to reconcile with their own ſyſtems; and theſe I have quoted to ſhew how eaſily theſe difficulties are removed, by the admiſſion of the ſyſtem which I now offer to the public.

Theſe alone being the motives by which I have been influenced, I hope it will be conſidered as a proof, that no offence was intended to be given; as I have taken no other liberty with the works of others, than what any perſon is perfectly at liberty to take with theſe ſheets.

I do not wiſh implicit confidence to be given to what has been advanced, any farther than it may carry conviction with it. As every candid inquirer into truth can only give his aſſent to what is well founded, and muſt reject that which is not ſo; the obſervations of philoſophical and impartial inquirers into the ſubject, whether they tend to eſtabliſh or diſcover any imperfection in the ſyſtem I offer, will be always received with attention, when I find the improvement of it to be their object. On the very great importance of the ſubject, it is needleſs to make any obſervation; and as for myſelf I can ſay, that I have conſidered it with great attention, and am ſatisfactorily convinced, and do firmly believe, that the uſe of the lymphatic ſyſtem is to perform both the office of *nutrition* and *abſorption*, in the manner I have repreſented.

I have conſidered the ſubject in a variety of views; and every thing that I have been enabled to obſerve and conſider, has tended to convince me, that this opinion is well founded; and what muſt be a recommendation to it, is its great ſimplicity, which is a conſideration deſerving of particular attention; for what can be more ſimple, than that the chyle being preſſed into the circulation; the lymphs ſhould be conveyed by ſimilar means through the lymphatic glands and veſſels, into every part of the body for its nutrition; and alſo, that when this fluid is exhauſted, the ſame veſſels, when empty, will abſorb fluids, and convey them through the ſame paſſages into the circulation, from every part of the body. This ſimplicity is congenial with what we know of the operations of nature; for when they appear to us to be involved in difficulties or obſcurity, it is cauſed by our ignorance of that ſimplicity with which they were performed.

I have not the leaſt doubt, that as ſoon as the lymphatic ſyſtem is univerſally and incontrovertibly eſtabliſhed, that a perfect knowledge of the whole of the animal œconomy will be obtained; and the cauſe, as well as the treatment, of the different diſeaſes, be perfectly underſtood; which will remove that uncertainty which at preſent prevails, and muſt ever be the conſequence, until the perfect knowledge of the real importance and uſe of the Lymphatic Syſtem be obtained.

FINIS.

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